PART 1

WORLD REVIEW OF FISHERIES AND AQUACULTURE

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Fisheries resources: trends in production, utilization and trade

OVERVIEW

Global production from capture fisheries and aquaculture supplied about 101 million tonnes of food fish in 2002, providing an apparent per capita supply of 16.2 kg (live weight equivalent), with aquaculture accounting for the growth in per capita supply since 2000 (Tables 1 and 2 and Figures 1 and 2). Outside China, the world's population has been increasing more quickly than the total food fish supply; as a result the average per capita fish supply outside China declined from 14.6 kg in 1987 to 13.2 kg in 1992 and has since remained stable (Figure 2). Overall, fish provided more than 2.6 billion people with at least 20 percent of their average per capita animal protein intake. The share of fish proteins in total world animal protein supplies grew from 14.9 percent in 1992 to a peak of 16.0 percent in 1996 and remained close to that level (15.9 percent) in 2001.

Preliminary estimates for 2003 based on reporting by some major fishing countries indicate that total world fishery production decreased slightly (–1 percent) compared with 2002. However, the total amount of fish available for human consumption increased to 103 million tonnes and, on average, the per capita supply was maintained. The decrease in capture fisheries resulting from the contraction of reduction fisheries in some major fishmeal-producing countries was partly compensated for by increases in other food fisheries and aquaculture.

Table 1
World fisheries production and utilization

	1998	1999	2000	2001	2002	2003[1]
			(million tonnes)			
PRODUCTION						
INLAND						
Capture	8.1	8.5	8.7	8.7	8.7	9.0
Aquaculture	18.5	20.2	21.3	22.5	23.9	25.2
Total inland	**26.6**	**28.7**	**30.0**	**31.2**	**32.6**	**34.2**
MARINE						
Capture	79.6	85.2	86.8	84.2	84.5	81.3
Aquaculture	12.0	13.3	14.2	15.2	15.9	16.7
Total marine	**91.6**	**98.5**	**101.0**	**99.4**	**100.4**	**98.0**
Total capture	87.7	93.8	95.5	92.9	93.2	90.3
Total aquaculture	30.6	33.4	35.5	37.8	39.8	41.9
Total world fisheries	**118.2**	**127.2**	**131.0**	**130.7**	**133.0**	**132.2**
UTILIZATION						
Human consumption	93.6	95.4	96.8	99.5	100.7	103.0
Non-food uses	24.6	31.8	34.2	31.1	32.2	29.2
Population *(billions)*	5.9	6.0	6.1	6.1	6.2	6.3
Per capita food fish supply *(kg)*	15.8	15.9	15.9	16.2	16.2	16.3

Note: Excluding aquatic plants.
[1] Preliminary estimate.

China remains by far the largest producer, with reported fisheries production of 44.3 million tonnes in 2002 (16.6 and 27.7 million tonnes from capture fisheries and aquaculture, respectively), providing an estimated domestic food supply of 27.7 kg per capita as well as production for export and non-food purposes. However, there are continued indications that capture fisheries and aquaculture production statistics for China may be too high, as indicated in *The State of World Fisheries and*

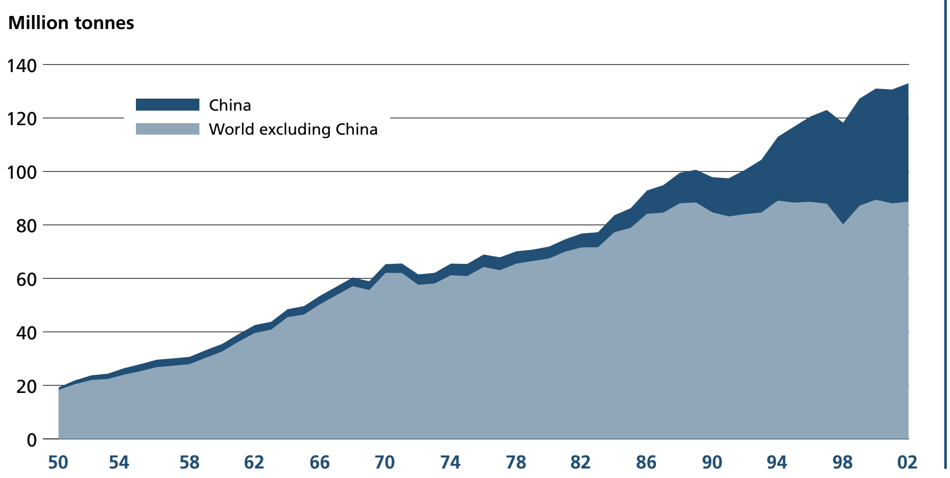
Table 2
Fisheries production and utilization: world excluding China

	1998	1999	2000	2001	2002	2003[1]
			(million tonnes)			
PRODUCTION						
INLAND						
Capture	5.8	6.2	6.5	6.5	6.5	6.5
Aquaculture	5.3	6.0	6.1	6.6	6.9	7.5
Total inland	**11.1**	**12.2**	**12.6**	**13.1**	**13.4**	**14.0**
MARINE						
Capture	64.7	70.3	72.0	69.8	70.1	67.0
Aquaculture	4.4	4.7	4.8	5.1	5.1	5.5
Total marine	**69.1**	**75.0**	**76.8**	**74.9**	**75.2**	**72.5**
Total capture	70.4	76.5	78.5	76.3	76.6	73.5
Total aquaculture	9.8	10.7	10.9	11.7	12.0	13.0
Total fisheries production	**80.2**	**87.2**	**89.4**	**88.1**	**88.7**	**86.5**
UTILIZATION						
Human consumption	62.3	62.9	63.7	65.6	65.5	66.8
Non-food uses	17.9	24.3	25.7	22.5	23.2	19.7
Population *(billions)*	4.7	4.7	4.8	4.9	5.0	5.0
Per capita food fish supply *(kg)*	13.3	13.2	13.2	13.4	13.2	13.3

Note: Excluding aquatic plants.
[1] Preliminary estimate.

Figure 1

World capture and aquaculture production



Aquaculture 2002,[1] and that this problem has existed since the early 1990s. Because of the importance of China and the uncertainty about its production statistics, China, as in previous issues of this report, is generally discussed separately from the rest of the world.

Global landings from capture fisheries (Figure 3) remained relatively stable in the four years 1999–2002. World capture fisheries production in 2002 was 93.2 million tonnes (84.5 million tonnes marine and 8.7 million tonnes inland), slightly above production in 2001. After increasing from about 79 million tonnes in 1998 to 87 million tonnes in 2000, the world marine capture fisheries production decreased to about 84 million tonnes in 2001 and remained at that level in 2002. Inland capture fisheries production fluctuated slightly around 8.7 million tonnes during 2000–02.

There are considerable variations in marine catches among regions. Between 2000 and 2002, catches decreased in the Northwest and Southeast Pacific, and in the Eastern Central and Southwest Atlantic, but were still growing in the tropical regions

Figure 2

World fish utilization and supply, excluding China

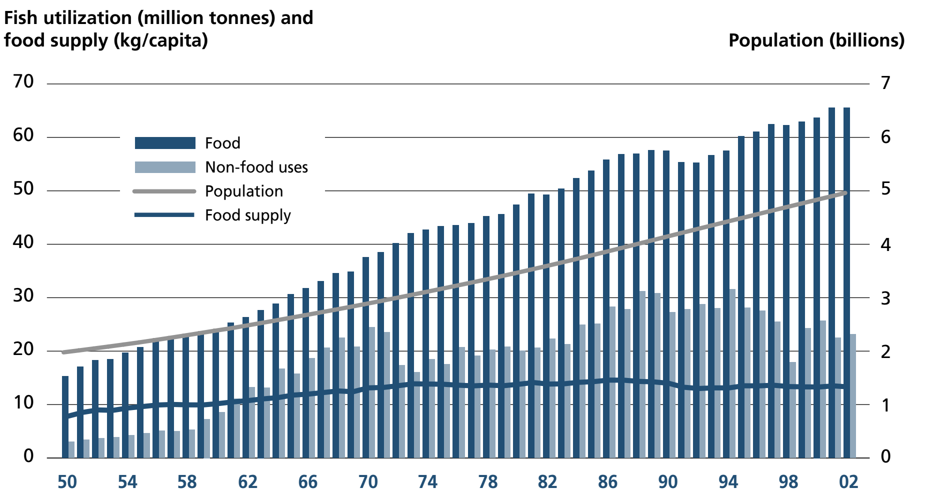
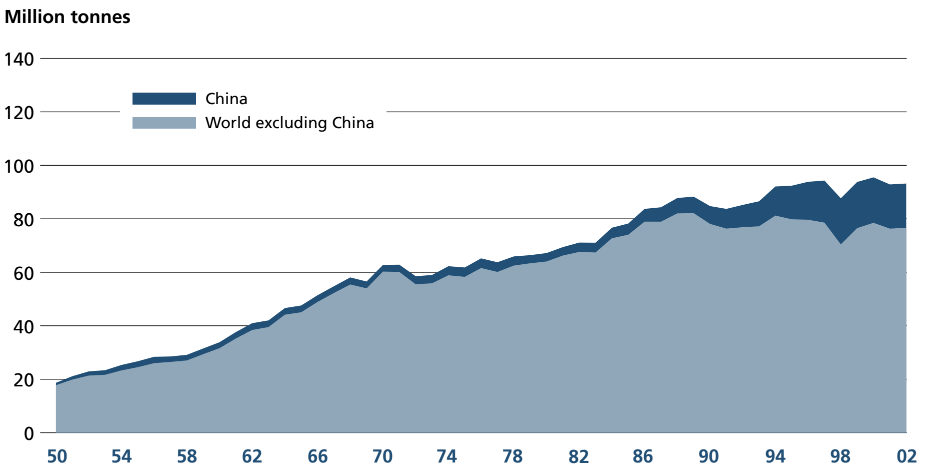


Figure 3

World capture fisheries production



[1] FAO. *The State of World Fisheries and Aquaculture 2002*. Rome, Box 2, p. 9.

of the Indian and Pacific Oceans. Catches in the temperate Northeast Atlantic and Mediterranean did not show significant variations, while in the Northwest Atlantic and in the Northeast Pacific, total catches increased in 2001 and remained stable in 2002. There has been a consistent downward trend since 1974 in the proportion of stocks offering potential for expansion, coupled with an increase in the proportion of overexploited and depleted stocks, from about 10 percent in the mid-1970s to close to 25 percent in the early 2000s (see Figure 19, p. 32). The percentage of stocks exploited at or beyond their maximum sustainable levels varied widely among fishing regions. Information available continues to confirm that, despite local differences, the global potential for marine capture fisheries has been reached, and more rigorous plans are needed to rebuild depleted stocks and prevent the decline of those being exploited at or close to their maximum potential.

By contrast, global production from aquaculture continues to grow, in terms of both quantity and its relative contribution to the world's supply of fish for direct human consumption. Production in 2002 (51.4 million tonnes,[2] with China accounting for 71 percent) was 6.1 percent higher than in 2000. The aquaculture sector, excluding China, contributed 12 million tonnes to food fish supplies[3] in 2002, compared with 53 million tonnes from capture fisheries (China produced 28 million tonnes from aquaculture and 7 million tonnes from capture fisheries). Aquaculture production of food fish continues to be mainly (57.7 percent) from freshwater. Developing countries accounted for 90.7 percent of production in 2002, consisting of predominantly herbivorous/omnivorous or filter-feeding species. All continents showed increases in production during 2000–02 with the exception of Europe, where production remained relatively unchanged. Growth in production of the major species groups continues to be rapid, although, with the exception of crustaceans, there were signs of a slowdown during 2000–02. The shift to sustainable culture practices and development strategies remains a work in progress and a key objective; some countries (mainly developed countries) have achieved significant advances in this respect, but in many others much still remains to be done.

In 2002, about 76 percent (100.7 million tonnes) of estimated world fisheries production was used for direct human consumption. The remaining 24 percent (32.2 million tonnes) was destined for non-food products, mainly the manufacture of fishmeal and oil, slightly (0.4 percent) above levels in 1999 but 5.8 percent below levels in 2000.

Total world trade of fish and fishery products increased to US$58.2 billion (export value) in 2002, up 5 percent relative to 2000 and showing a 45 percent increase since 1992. In terms of quantity, exports were reported to be 50 million tonnes in 2002,[4] a slight decrease (1 percent) from the 2000 level. The quantity of fish traded has been stagnant in the last few years following decades of strong increases, and it is unlikely that the increasing trends of pre-2000 years will be repeated in the short term.

The number of individuals earning an income from primary sector employment in fisheries and aquaculture in 2002 reached about 38 million (see Table 7, p. 22), a marginal increase over 2001. Of these, more than one-third were employed full-time and the rest were part-time and occasional workers. Together, this workforce represented 2.8 percent of the 1.33 billion people who were economically active in agriculture worldwide, compared with 2.3 percent in 1990. The highest numbers of fishers and aquaculture workers (85 percent worldwide) are in Asia, with China accounting for nearly one-third of the world total. The share of employment in capture fisheries is stagnating in the most important fishing nations and increased opportunities are being provided by aquaculture. Since 2000, however, in some developed countries, employment in aquaculture has started to level off, in parallel with the observed slowdown in the growth of production for some species.

The vast majority of the world fishing fleet is concentrated in Asia (about 85 percent of total decked vessels, 50 percent of powered undecked vessels and 83 percent of

[2] Includes aquatic plants.

[3] Finfish and shellfish products on a whole, live weight basis.

[4] Live weight equivalent.

total non-powered boats). In 2002, the number of large vessels increased to 24 406, but growth has halted as many nations have adopted capacity containment programmes. Records show that in 2002 about 13 percent of these large vessels were less than ten years old, and 28 percent were above 30 years of age (compared with 30 and 6 percent, respectively, in 1992). Indications are that the fleet size of some major fishing nations has continued to decrease.

A clear shift in the role of regional fishery bodies (RFBs) has occurred since the adoption of key international fisheries instruments following the 1992 United Nations Conference on Environment and Development (UNCED). Many RFBs have reviewed or amended their respective agreements or conventions in response to their strengthened post-UNCED role in conservation and management. Generally, they are taking innovative and cooperative action to implement international fisheries instruments, many of these in an effort to rebuild depleted stocks, prevent further decline and to combat illegal, unreported and unregulated (IUU) fishing. RFBs are constrained by the unwillingness of Member States to delegate sufficient decision-making power and responsibilities to the RFBs, and their reluctance to implement decisions taken by the RFBs. The movement of RFBs towards becoming bodies with fishery management functions is placing greater demands on their decision-making capacity.

CAPTURE FISHERIES PRODUCTION

Total capture fisheries production

In 2002, total capture fisheries production amounted to 93.2 million tonnes, slightly (0.3 million tonnes) above production in 2001 (Table 1). The first sale value of this catch amounted to around US$78 billion, representing a 1.6 percent decline compared with the value in 2000, partly caused by a decrease of catch and a decline of the unit value of landings for food consumption. Within the total value, reduction fisheries accounted for nearly US$3 billion. Global catches (Figure 3) remained stable during the last four years for which complete statistics are available (1999–2002), with the exception of 2000 when annual catches exceeded by over 2 million tonnes the level of preceding and subsequent years, a consequence of the remarkable increase in the environmentally driven recovery of stocks of Peruvian anchoveta. Preliminary estimates indicate that global marine catches decreased in 2003 by about 3 million tonnes compared with 2002. This decrease roughly corresponds to the drop in catches of Peruvian anchoveta and other reduction species in the Southeast Pacific.

The top ten capture fishery producing countries have not changed since 1992. In 2002, their cumulative catches represented 60 percent of the world total, with China and Peru still leading the ranking in both 2001 and 2002 (Figure 4). Capture production reported by China has remained fairly stable since 1998 (Figure 3), while trends in Peruvian total capture production are always strongly influenced by variations in anchoveta catches.

World marine capture fisheries production

Marine capture fisheries production in 2002 was 84.5 million tonnes, representing a decline of 2.6 percent with respect to 2000 and a minor increase of 0.4 percent in comparison with 2001 catches.

During the past decade, the reported landings of marine capture fisheries have fluctuated between 80 and 86 million tonnes (average 1993–2003, 84 million tonnes), a slight increase over the preceding decade (average, 77 million tonnes). It should be noted that, between the two periods, the quantity of marine fish caught and discarded has fallen by several million tonnes (see the section on discards in marine capture fisheries on pp. 122–127). This came about, *inter alia*, through improved gear selectivity and fishing practices (that reduced bycatch), fisheries management that decreased access to some stocks (by reducing allowable catches and including the closure of some fisheries), no-discard policies in some countries (that forced landings of all catches) and growing demand for fish combined with improved technologies and opportunities for utilizing bycatch. Despite the uncertainty regarding the total decrease in discards and the proportion of that decrease resulting from improved fisheries management, increased demand and improved processing, respectively, there is no doubt that marine capture fisheries are moving towards a more appropriate use of wild fish stocks.

The Northwest and Southeast Pacific are still the most productive marine fishing areas (Figure 5), although total catches in these two areas decreased by 1.8 and 2.0 million tonnes in 2002 compared with 2000 levels. Catches also decreased substantially from 2000 levels in the Eastern Central and Southwest Atlantic. In the former area, catches had increased in 2001 but decreased by more than 0.5 million tonnes in 2002, largely as a result of reduced small pelagic and cephalopod catches. In the Southwest Atlantic, cephalopod catches have declined even more dramatically, from 1.2 million tonnes in 1999 to 0.54 million tonnes in 2002. By contrast, catches were still growing in fishing areas that mostly lie in the tropical regions of the Indian and Pacific Oceans, where catches of large (mainly tuna) and small pelagic species continued to increase. Among the main fishing areas in temperate waters, total catches in the Northeast Atlantic and Mediterranean did not show significant variations, while in the Northwest Atlantic and in the Northeast Pacific, total catches increased in 2001 and remained stable in 2002.

After the high catches of 2000 (the third highest ever at 11.3 million tonnes), anchoveta decreased to 7.2 million tonnes in 2001 and recovered to 9.7 million tonnes

Figure 4

Marine and inland capture fisheries: top ten producer countries in 2002

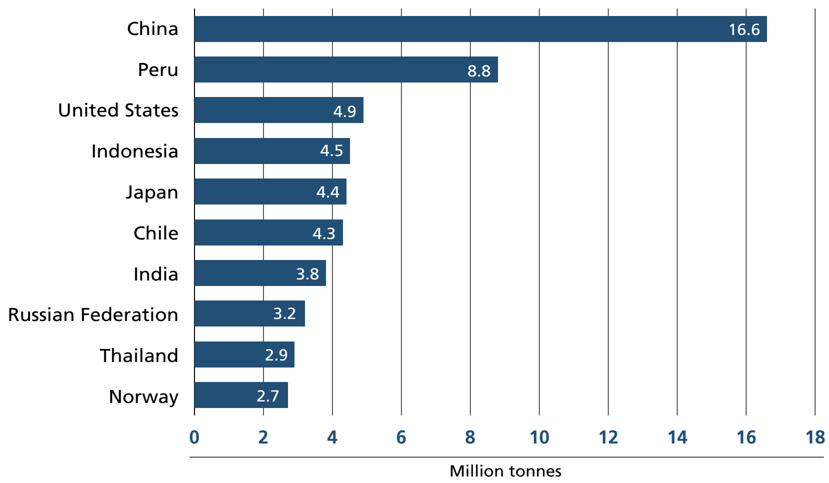
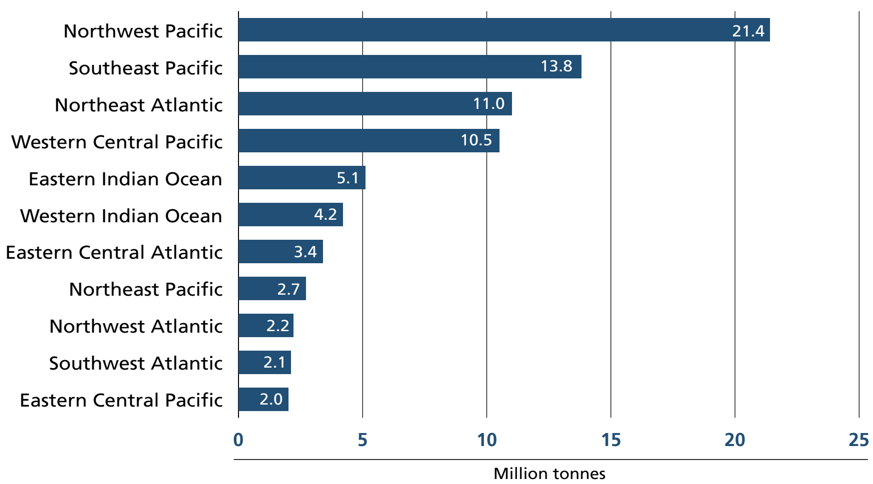


Figure 5

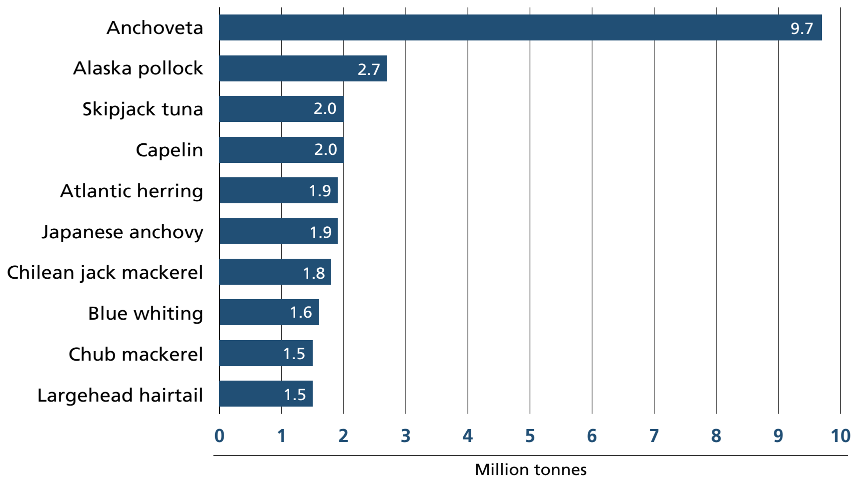
Capture fisheries production: principal marine fishing areas in 2002



Note: Fishing areas listed are those with a production quantity equal to or more than 2 million tonnes in 2002.

Figure 6

Marine capture fisheries production: top ten species in 2002



in 2002, ranking once again as the most caught marine species (Figure 6). Other major Clupeoid species (e.g. Atlantic herring, Japanese anchovy and European pilchard/ sardine) did not show a common catch trend in the latest years, as species belonging to this group are strongly influenced by the variability of local environmental conditions. Overall catches of the Gadiformes group of species (e.g. cods, hakes and haddocks) continued to decrease and by 2002 had reached their lowest levels since 1967. The value of these catches for food uses amounted to US$5.7 billion, representing 8 percent of the total value of landings for consumption. Alaska pollock and blue whiting, the two major species in terms of catches, but of low commercial value, also decreased in 2002 following a significant increase in 2001. After minor decreases in 2000 and 2001, total catches of tuna and tuna-like species exceeded 6 million tonnes for the first time in 2002, accounting for 11 percent of the total value of landings for consumption. Increased catches were also realized from tropical species such as skipjack (the third global species in 2002) and yellowfin tunas. Geographically, catches increased in the two central Pacific fishing areas and the Western Indian Ocean, while in the other fishing areas tuna catches were stable (e.g. the Eastern Indian Ocean) or decreasing (e.g. the Northwest and Southeast Pacific). Total catches of the three major small pelagic species (capelin, Chilean jack mackerel and chub mackerel) increased in 2001 by 33.2 percent in comparison with 2000 but decreased in 2002 by 13.5 percent from 2001 levels.

Catches of oceanic species occurring principally in high seas waters continued to increase (see Box 1).

Catches of the "sharks, rays, chimaeras" group have been stable since 1996 at about 0.8 million tonnes. However, a possible reduction of shark catches may be masked by the remarkable recent improvement in the species breakdown of reported catches (previously mostly combined under the generic item "Elasmobranchii" or even classified as "Marine fishes not identified") following the efforts of FAO and RFBs to improve shark statistics. In 1996, the FAO capture database included data for 45 species items in the shark group; this more than doubled to 95 species items in 2002 and now represents more than 7 percent of the total, at 1 347.

Total catch production of both marine crustaceans and molluscs declined slightly from their 2000 peak over the following two years. Production trends of cephalopods since the low catches recorded in 1998 have shown marked variation among the three major species: catches of the Eastern Pacific jumbo flying squid rose steeply (2002 catches were 15 times higher than those in 1998); catches of the Western Pacific Japanese flying squid grew markedly in 1999 and 2000 but have been decreasing since; and catches of the Argentine shortfin squid, which in 1999 had reached 1.1 million tonnes in the Southwest Pacific, dropped in the subsequent three years and by 2002 were half of the 1999 maximum.

Box 1

Catch and trade of oceanic species

Species items reported in the FAO capture production database were classified as oceanic, further subdivided into epipelagic and deep-water species, or living on the continental shelf.[1] A scrutiny of the new species included in the capture database in the latest three updates (2000–2002) showed that 35 more species items (mostly deep-water species) should have been added to those previously selected, reaching a total of 155 oceanic species. This considerable rise in reported deep-water species is probably a result of the growing awareness of deep-water fishing activities that has prompted flag states to improve their monitoring and reporting of deep-water catches, rather than a dramatic increase in deep-water fishing.

In 2002, the share of oceanic catches in global marine catches reached 11 percent. Catches of deep-water species decreased in 2002 after the highest catches ever in 2001, while catches of oceanic tuna decreased in 2000 and 2001 and reached a maximum in 2002 (Figure A). Catches of other epipelagic species, mainly oceanic squids, have been increasing steeply since a drop in 1998 and also reached a peak in 2002.

A significant proportion of the landings of oceanic species enters international marketing channels in various product forms. In 2002, exports of oceanic species accounted for 7 percent of the quantity and of 10 percent of the value of total exports of fish and fishery products. In recent decades, the marked increase in catches of oceanic species was paralleled by a growth in trade of oceanic species, which increased, in terms of live weight equivalent, from 0.6 million tonnes in 1976 to about 3.6 million tonnes in 2002, and in value terms from US$0.5 billion to US$5.9 billion over the same period (Figure B). Most of these exports consisted of tuna products, also a result of the inadequate identification of other oceanic species in international commodity classifications.

[1] For criteria adopted and further reading, see FAO. 2003. *Trends in oceanic captures and clustering of large marine ecosystems: two studies based on the FAO capture database*, by L. Garibaldi and L. Limongelli. FAO Fisheries Technical Paper No. 435. Rome (available at http://www.fao.org/DOCREP/005/Y4449E/y4449e03.htm; accessed September 2004).

Figure A

World catches of oceanic species (epipelagic and deep-water) occurring principally in high seas areas

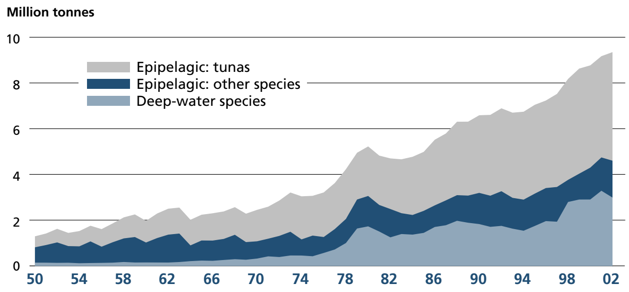
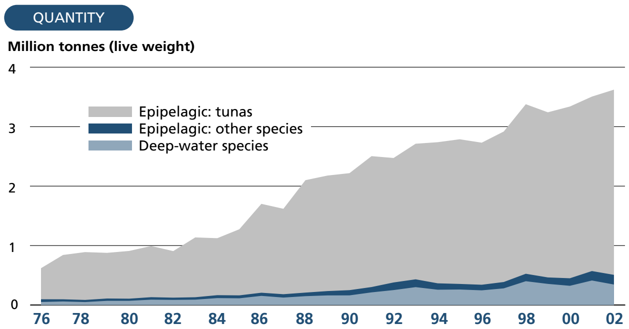
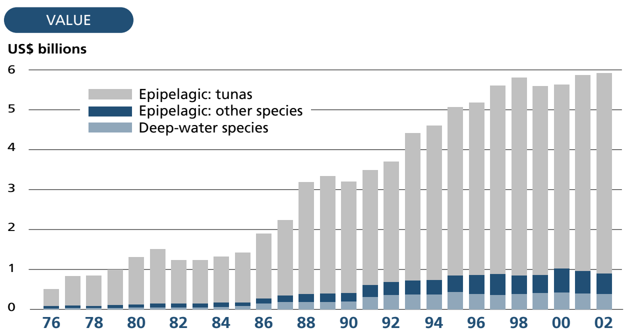


Figure B

World exports of oceanic species



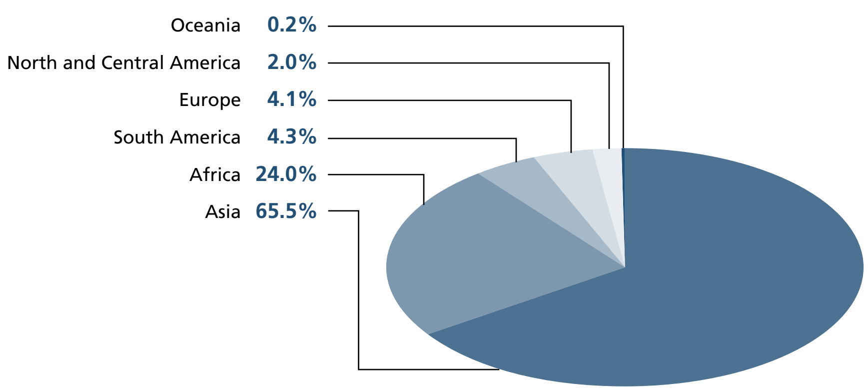


World inland capture fisheries production

Total catches from inland waters remained stable at around 8.7 million tonnes in the 2000–02 period. It should be noted, however, that reporting of global inland fisheries production continues to present problems owing to the lack of reliable information on catch quantities and species composition. In many countries, catches by rural communities, who are often the main users of the resource, are not reported in national statistics. Accordingly, the figures on total catch provided here should be considered indicative.

Figure 7

Inland capture fisheries by continent in 2002



Note: World inland capture fisheries production amounted to 8.7 million tonnes in 2002.

Figure 8

Inland capture fisheries: top ten producer countries in 2002

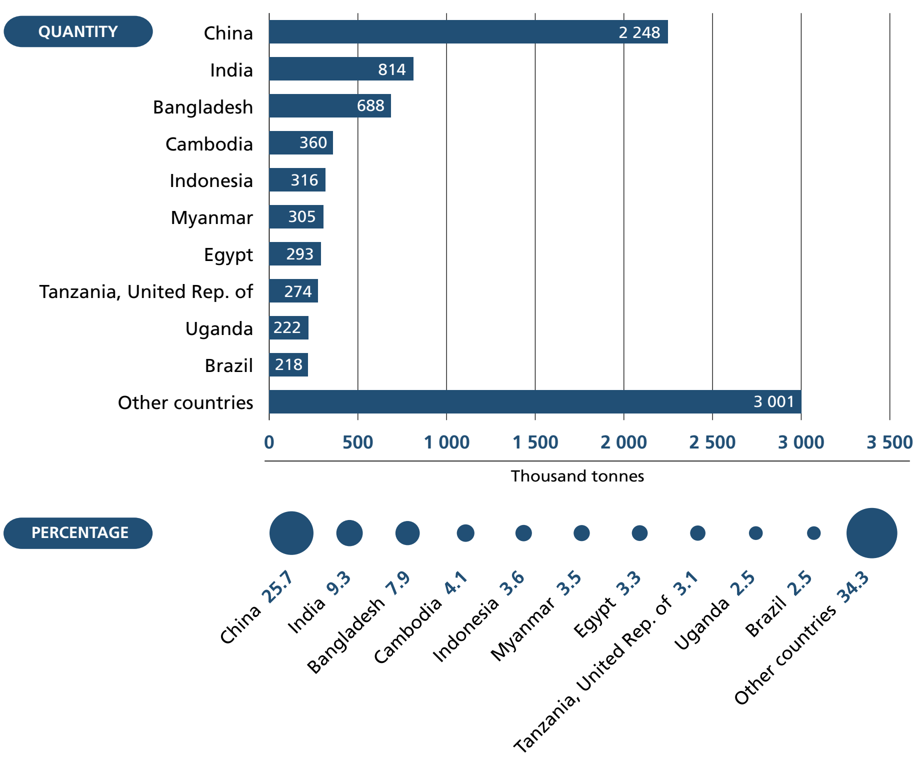
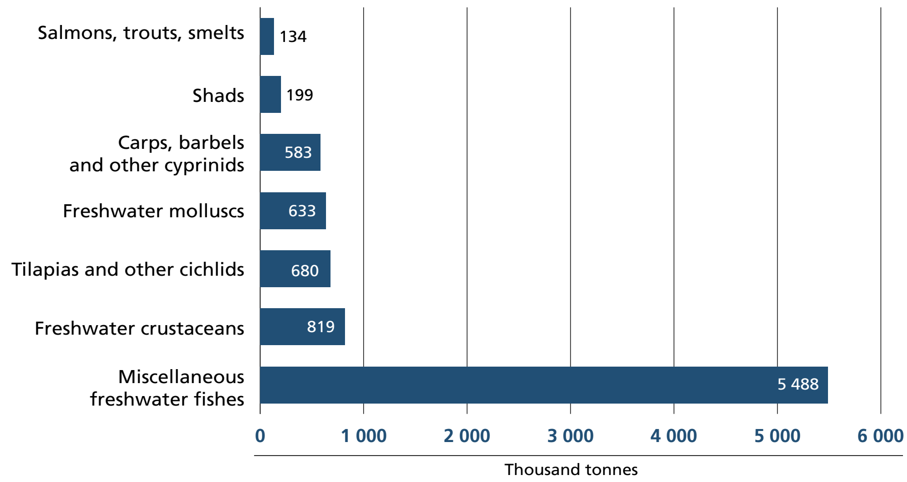


Figure 9

Inland capture fisheries: major species groups in 2002



Africa and Asia contributed about 90 percent of global inland capture production in 2002 (Figure 7). Compared with 2000, catches in 2002 have grown by about 0.6 percent in the Asia inland fishing area, 2 percent in Africa, and 9 percent in South America. Catches decreased in Europe (by 18 percent), North and Central America (by 9.8 percent) and Oceania (by 0.5 percent).

The principal ten producers accounted for about 66 percent of global production from inland capture fisheries in 2002 (Figure 8). China, the top producer, has reported stable inland catches since 1998 and still produces one-quarter of the global inland catches. The Russian Federation and Kenya, which ranked fifth and tenth respectively in 2000, dropped out of the top ten list in 2002 and were superseded by Myanmar and Brazil. The Russian Federation now ranks twelfth following a dramatic decrease in catch during the last two years.

The bulk of world production (68.1 percent) came from developing countries other than China and only 6.1 percent from developed countries, classified either as “Economies in transition” or as “Industrialized countries” (Table 3). The divergence between developed and developing countries in the importance of inland catches is further evidenced by the fact that, in 2002, not one developed country was among the top ten world producers (Figure 8).

Reporting of inland catch by species group remains very poor for many countries and does not permit detailed analysis of trends in catch composition given the unknown portion of catches that may have been reported at higher taxonomic levels or not identified at all. In 2002, about 50 percent of the global inland water catches were reported as “Freshwater fishes not elsewhere included” (Figure 9). China accounts for the great majority of reported world catches of freshwater crustaceans (94 percent)

Table 3
Inland capture fisheries production by economic class

Economic class	Production in 2002 *(million tonnes)*	Percentage of world production
China	2.25	25.7
Other developing countries or areas	5.95	68.1
Economies in transition	0.32	3.6
Industrialized countries	0.22	2.5
Total	**8.74**	

and molluscs (87 percent). Compared with 2000 levels, reported catches for 2002 of freshwater crustaceans were higher by about 44 percent, carps and other cyprinids by 3.7 percent and molluscs by 6 percent, while tilapia catches remained stable. Catches of the "shads" group were the highest ever in 2000 but more than halved in 2002.

AQUACULTURE PRODUCTION

According to FAO statistics, the contribution of aquaculture to global supplies of fish, crustaceans and molluscs continues to grow, increasing from 3.9 percent of total production by weight in 1970 to 29.9 percent in 2002. Aquaculture continues to grow more rapidly than all other animal food-producing sectors. Worldwide, the sector has grown at an average rate of 8.9 percent per year since 1970, compared with only 1.2 percent for capture fisheries and 2.8 percent for terrestrial farmed meat-production systems over the same period. Production from aquaculture has greatly outpaced population growth, with the world average per capita supply from aquaculture increasing from 0.7 kg in 1970 to 6.4 kg in 2002, representing an average annual growth rate of 7.2 percent, based largely on China-reported growth.

In 2002, total world aquaculture production (including aquatic plants) was reported to be 51.4 million tonnes by quantity and US$60.0 billion by value. This represents an

Table 4
Top ten producers in aquaculture production: quantity and growth

Producer	2000	2002	APR
	(thousand tonnes)		*(percent)*
Top ten producers in terms of quantity			
China	24 580.7	27 767.3	6.3
India	1 942.2	2 191.7	6.2
Indonesia	788.5	914.1	7.7
Japan	762.8	828.4	4.2
Bangladesh	657.1	786.6	9.4
Thailand	738.2	644.9	-6.5
Norway	491.2	553.9	6.2
Chile	391.6	545.7	18.0
Viet Nam	510.6	518.5	0.8
United States	456.0	497.3	4.4
Top ten subtotal	31 318.8	35 248.4	6.1
Rest of the world	4 177.5	4 550.2	4.4
Total	**35 496.3**	**39 798.6**	**5.9**
Top ten producers in terms of growth			
Iran (Islamic Rep. of)	40.6	76.8	37.6
Faeroe Islands	32.6	50.9	25.0
Lao People's Dem. Rep.	42.1	59.7	19.1
Brazil	176.5	246.2	18.1
Chile	391.6	545.7	18.0
Russian Federation	74.1	101.3	16.9
Mexico	53.9	73.7	16.9
Taiwan Province of China	243.9	330.2	16.4
Canada	127.6	172.3	16.2
Myanmar	98.9	121.3	10.7

Note: Data exclude aquatic plants. APR refers to the average annual percentage growth rate for 2000–02.

Table 5
World aquaculture production: average annual rate of growth for different species groups

Time period	Crustaceans	Molluscs	Freshwater fish	Diadromous fish	Marine fish	Overall
	(percent)					
1970–2002	**18.1**	**7.8**	**9.6**	**7.4**	**10.5**	**8.9**
1970–1980	23.9	5.6	6.0	6.5	14.1	6.3
1980–1990	24.1	7.0	13.1	9.4	5.3	10.8
1990–2000	9.9	5.3	7.8	7.9	12.3	10.5
2000–2002	**11.0**	**4.6**	**5.8**	**6.7**	**9.5**	**5.9**

annual increase of 6.1 percent in quantity and 2.9 percent in value, respectively, over reported figures for 2000. In 2002, countries in Asia accounted for 91.2 percent of the production quantity and 82 percent of the value. Of the world total, China is reported to produce 71.2 percent of the total quantity and 54.7 percent of the total value of aquaculture production.

Table 4 shows the top ten producers of fish, crustaceans and molluscs in 2002, together with the top ten producers in terms of annual growth in aquaculture production in 2000–02. All continents except Europe showed increases in production from 2000 to 2002; in Europe production remained relatively unchanged (0.1 percent annual decrease).

World aquatic plant production in 2002 was 11.6 million tonnes (US$6.2 billion), of which 8.8 million tonnes (US$4.4 billion) originated from China, 0.89 million tonnes from the Philippines and 0.56 million tonnes from Japan. Japanese kelp (*Laminaria japonica* – 4.7 million tonnes) showed the highest production, followed by Nori (*Porphyra tenera* – 1.3 million tonnes). An additional 4 million tonnes were reported by countries as "Aquatic plants" and not further specified.

The rapid growth in production of the different major species groups continues. However, in the period 2000–02 there were indications that the extraordinary growth rates seen in the 1980s and 1990s were slowing slightly (Figure 10, Table 5). Although the growth in production of crustaceans increased in the period 2000–02, growth rates for the other species groups had begun to slow and the overall growth rate, while

Figure 10

Trends in world aquaculture production: major species groups

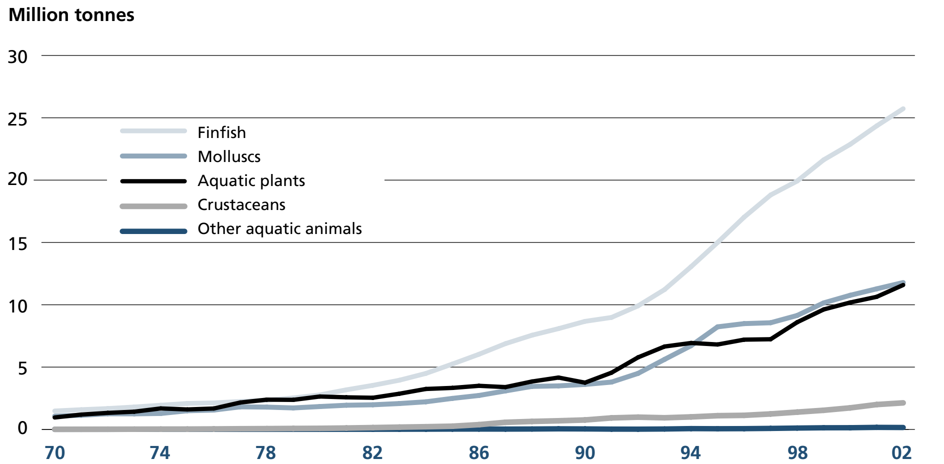
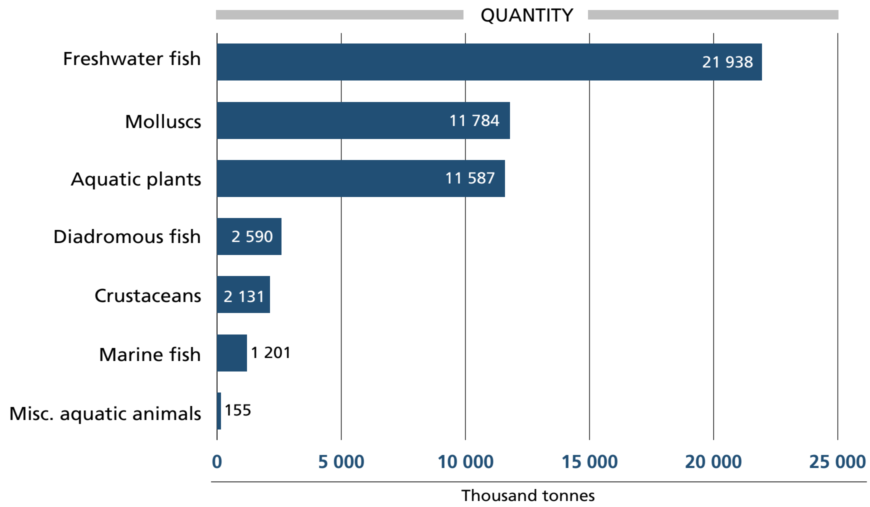
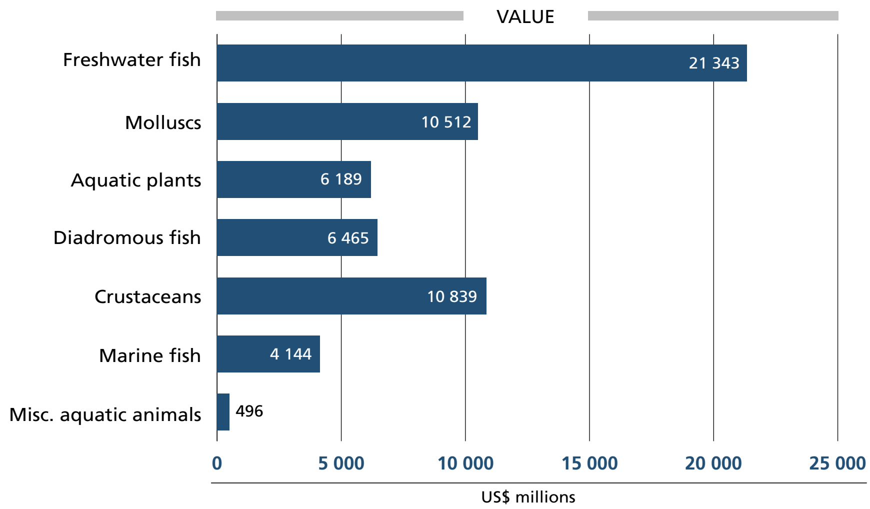


Figure 11

World aquaculture production: major species groups in 2002





still substantial, was lower than those experienced over the past 20 years. Aquaculture production in terms of quantity and value for major species groups in 2002 is presented in Figure 11.

The top ten species groups in terms of production quantity and percentage increase in production quantity from 2000 to 2002 are presented in Table 6. Production of carps and other cyprinids far exceeded that for all other species groups, accounting for nearly 42 percent (16.7 million tonnes) of total production of fish, crustaceans and molluscs. Combined, the top ten species groups accounted for 92.5 percent of the total aquaculture production of fish, crustaceans and molluscs. The largest production for an individual species was the Pacific cupped oyster (*Crassostrea gigas* – 4.2 million tonnes), followed by three species of carp – the silver carp (*Hypophthalmichthys molitrix* – 4.1 million tonnes), grass carp (*Ctenopharyngodon idellus* – 3.6 million tonnes) and common carp (*Cyprinus carpio* – 3.2 million tonnes).

Two high-value species of finfish appear in the top ten species groups in Table 6, with the largest percentage increases in production reflecting emerging activities. First, farming of Atlantic cod (*Gadus morhua*) has begun in Norway and Iceland. Second, the aquaculture of wild-caught tuna by fattening in sea-cages is an increasingly important

Table 6
Top ten species groups in aquaculture production: quantity and growth

Species group	2000	2002	Share of 2002 total	APR
	(tonnes)		(percent)	
Top ten species groups in terms of quantity				
Carps and other cyprinids	15 451 646	16 692 147	41.9	3.9
Oysters	3 997 394	4 317 380	10.8	3.9
Miscellaneous marine molluscs	2 864 199	3 739 702	9.4	14.3
Clams, cockles, arkshells	2 633 441	3 430 820	8.6	14.1
Salmons, trouts, smelts	1 545 149	1 799 383	4.5	7.9
Tilapias and other cichlids	1 274 389	1 505 804	3.8	8.7
Mussels	1 370 953	1 444 734	3.6	2.7
Miscellaneous marine molluscs	1 591 813	1 348 327	3.4	-8.0
Shrimps, prawns	1 143 774	1 292 476	3.2	6.3
Scallops, pectens	1 154 470	1 226 568	3.1	3.1
Top ten species groups in terms of growth				
Cods, hakes, haddocks	169	1 445		192.4
Misc. demersal fishes	8 701	15 302		32.6
Misc. marine crustaceans	34 202	52 377		23.7
Flounders, halibuts, soles	26 309	38 909		21.6
Tunas, bonitos, billfishes	6 447	9 445		21.0
Freshwater crustaceans	411 458	591 983		19.9
Crabs, sea-spiders	140 235	194 131		17.7
Freshwater molluscs	10 220	13 414		14.6
Misc. freshwater fishes	2 864 199	3 739 702		14.3
Clams, cockles, arkshells	2 633 441	3 430 820		14.1

Note: Data exclude aquatic plants. APR refers to the average annual percentage growth rate for 2000–2002.

activity in Mexico, Australia and the Mediterranean region and is now spreading to other areas. According to FAO statistical definitions, the net weight gain in captivity should be attributed to aquaculture, but few countries known to have fattening operations have reported any production from tuna farming as aquaculture. Thus the increase suggested by the official statistics is only a small part of the actual increase in production.

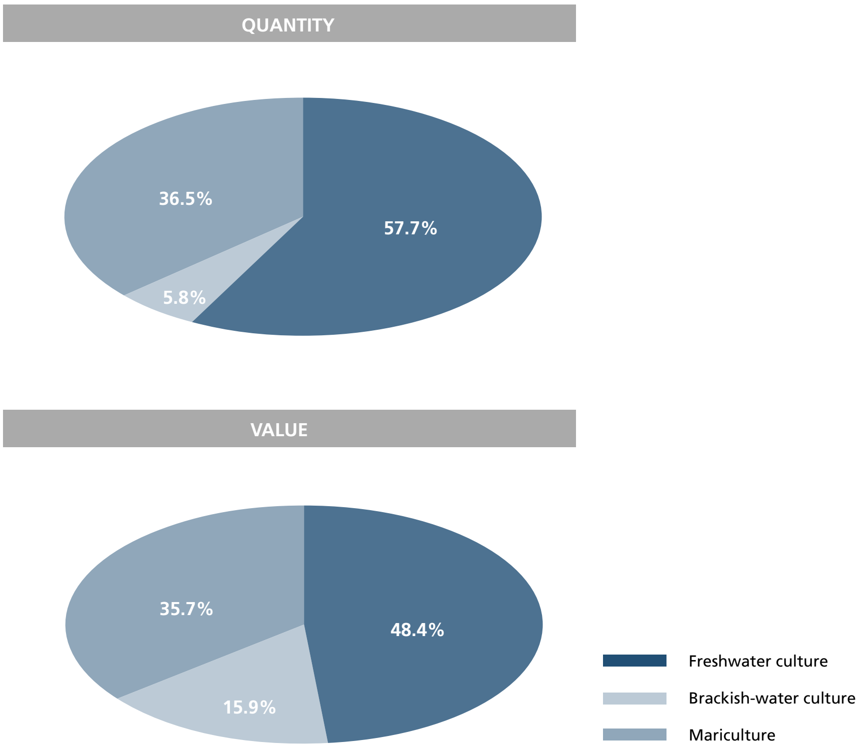
Most aquaculture production of fish, crustaceans and molluscs continues to come from the freshwater environment (57.7 percent by quantity and 48.4 percent by value) (Figure 12). Mariculture contributes 36.5 percent of production and 35.7 percent of the total value. Although brackish-water production represented only 5.8 percent of aquaculture production quantity in 2002, it contributed 15.9 percent of the total value, reflecting the prominence of high-value crustaceans and finfish. Aquaculture production trends for inland and marine waters over the period 1970–2000 are presented in Figure 13.[5]

During this period, reported Chinese inland water aquaculture production increased at an average annual rate of 11.1 percent, compared with 6.9 percent for the rest of the world. Similarly, reported Chinese aquaculture production in marine areas increased at an average annual rate of 10.9 percent compared with 5.5 percent for rest of the world.

[5] Brackish-water production is assigned to either marine areas or inland areas depending on the area reported by the country. Thus, production in inland areas and marine areas represents the total of aquaculture production.

Figure 12

World aquaculture production of fish, crustaceans and molluscs in 2002: breakdown by environment



Note: Data exclude aquatic plants.

Unlike terrestrial farming systems, where the bulk of global production is based on a limited number of animal and plant species, over 220 different farmed aquatic animal and plant species were reported in 2002. On the basis of aquaculture production statistics reported to FAO at the species level, the top ten species account for 69 percent of total production, and the top 25 species for over 90 percent.

It is noteworthy that the growth of aquaculture production of fish, crustaceans and molluscs in developing countries has exceeded the corresponding growth in developed countries, proceeding at an average annual rate of 10.4 percent since 1970. By contrast, aquaculture production in developed countries has been increasing at an average rate of 4.0 percent per year. In developing countries other than China, production has grown at an annual rate of 7.8 percent. In 1970, developing countries accounted for 58.8 percent of production, while in 2002 their share had risen to 90.7 percent. With the exception of marine shrimp, the bulk of aquaculture production in developing countries in 2002 comprised omnivorous/herbivorous fish or filter-feeding species. By contrast, 74 percent of the finfish culture production in developed countries was of carnivorous species.

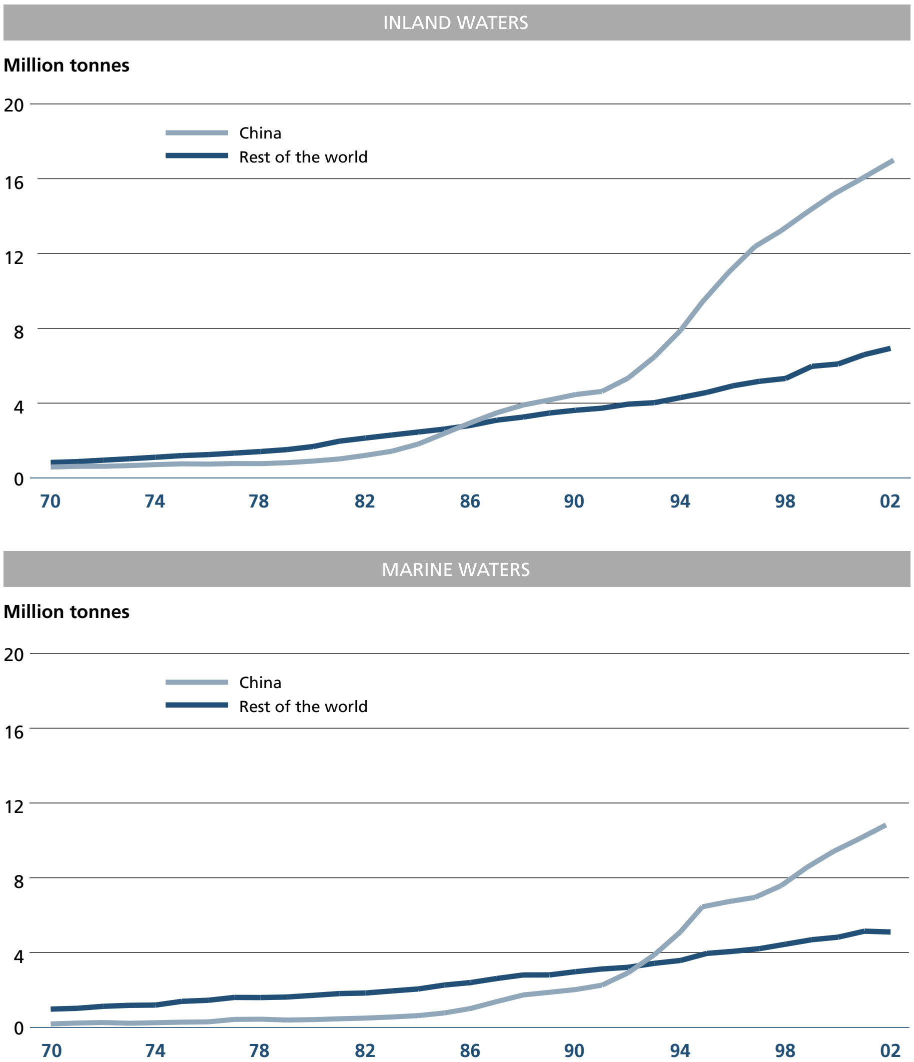
FISHERS AND FISH FARMERS

In 2002, fishery and aquaculture production activities provided direct employment and revenue to an estimated 38 million people (Table 7), a marginal increase compared with the previous year. The world number of fishers and fish farmers has been growing at an average rate of 2.6 percent per year since 1990.

Fishers and aquaculture workers represented 2.8 percent of the 1.33 billion people economically active in agriculture worldwide in 2002, compared with 2.3 percent in

Figure 13

Aquaculture production in marine and inland waters



Note: Data exclude aquatic plants.

1990. Most continents are close to the world average; exceptions are Africa, where the percentage of fishers and aquaculture workers is lower, at 1.3 percent of the total agricultural labour force, and North and Central America, where the share is 1 percent above the world average. Fishing in marine and inland waters accounted for 75 percent of the total number of workers, while aquaculture production provided employment for the remaining 25 percent. These figures are only indicative, as some countries do not yet collect employment data separately for the two sectors and some other countries' national systems do not yet account for fish farming.

The highest numbers of fishers and aquaculture workers are in Asia (87 percent of the world total) followed by Africa (7 percent), Europe, North and Central America and South America, (about 2 percent each) and Oceania (0.2 percent). These shares closely reflect the population shares of the different continents, the share of the population economically active in agriculture and the relative predominance of labour-intensive fisheries in some economies in Africa and Asia.

Fishing in marine and inland waters is often a part-time occupation (almost 60 percent of the total), as a result of the variations in seasonal resource availability and also because fishing is generally regulated through a series of

Box 2

Emergencies and fisheries

Natural hazards such as cyclones, floods, typhoons, sea surges, tidal waves, earthquakes and landslides can have a devastating effect on fishing communities – destroying fishing boats and equipment, or sweeping away their houses. A compelling example is the 1996 cyclone in the Bay of Bengal in which 1 435 fishers were reported as dead or missing and thousands of fishing crafts and other equipment were estimated to be lost or damaged.

When, following a disaster, fishing communities are no longer able to meet their basic survival needs and/or when there is a threat to their life and well-being, as in the case of armed conflicts, they face an emergency situation. Developing countries, especially the poorest, suffer disproportionately from emergencies because they lack the means to prepare for them and to deal with their aftermath. In view of the importance of fisheries in developing states (in terms of production, protein intake, employment and foreign exchange), there is a need to review the role that fisheries interventions can play in emergency relief operations.

In situations of emergency, fisheries interventions may be critical to help restore production and/or as a source of immediate income and food. Data gathered in the Sudan (northern sector) over a one-year cycle have shown that whatever the season and the location, fish commodities (mainly sun-dried fish) form the cheapest and most accessible source of animal proteins for the displaced and poor sections of the communities. Furthermore, sun-dried fish plays a crucial role in ensuring people's food security during the period between the first rains and first harvest (the "hunger gap") and during the active

measures that limit year-round activity (e.g. closures of selected fisheries at certain times of the year, limits on total annual catches of selected species so that commercial fishers may fish for only a few days of each month until the quota is reached) or limit the number of commercial licences and the number of fish caught per trip. Increasingly, operators have to turn to other activities for supplementary income.

Although the national statistics available to FAO are often too irregular and lacking in detail to permit a more in-depth analysis of the employment structure at world level, it is apparent that, in most important fishing nations that systematically provide this information, the share of employment in capture fisheries is stagnating and increased opportunities are being provided by aquaculture.

In China, where the combined numbers of fishers and fish farmers (12.3 million) represent nearly one-third of the world total, in 2002, 8.4 million people worked in capture fisheries and 3.9 million in aquaculture. However, existing fleet-size reduction programmes in China, aimed at reducing overfishing, are reducing the number of full-time and part-time fishers. The latter have decreased by almost 2 percent from two years before and there are plans to move 4 percent of the total number of fishers to other jobs by 2007. The policy tools to accomplish this include, among others, scrapping vessels and training redundant fishers in fish farming, where employment in 2002 increased by 6 percent compared with 2000 levels. A similar trend of increased

agricultural planting season, when it is used to supplement wild indigenous foods.

A distinction between aquaculture and capture fisheries should be made here. The raising of fish through aquaculture requires both time and money. As a consequence, relief efforts should focus on restarting production where aquaculture operations had already been established and where the necessary skills are available. By contrast, the capture of wild fish can provide immediate income and food (animal proteins) as soon as the means of production are renewed. This can be crucial in times of conflict or acute crises. Furthermore, in the case of capture fisheries, entrance into the sector and access to the fishing ground are generally non-discriminatory. Fishing equipment such as nets and hooks are easy to transport, unlike livestock. Some fishing activities, such as the use of hooks and lines, do not require high levels of skills to be developed, and can thus provide children and women, who are the most vulnerable, with proteins soon after displacement.

Moreover, fisheries interventions offer multiple side activities and job opportunities such as net repair, boatbuilding, fish processing, trade and basket-making. Fisheries interventions can contribute to promoting the role of women through training in improved fish-processing and preservation techniques.

In spite of the significant role fisheries can and should play in relief and rehabilitation efforts, fisheries interventions do not always receive adequate attention in emergency operations. Until this situation is addressed and the potential impact of fisheries interventions is realized, the costs will continue to be borne by fishers and their communities.

employment opportunities in professions associated with culture practices is also evident in other countries.

In many industrialized countries, notably Japan and European countries, employment in fishing – and, as a consequence, in associated land-based professions – has been declining for several years. This is the result of several factors combined, including lower catches, programmes to reduce fishing capacity and the increased productivity brought about by technical progress. In the European Union (EU-15)[6] the decline in the number of fishers in recent years averaged about 2 percent per year.

In Norway, employment in fishing has been decreasing for several years (Table 8). In 2002, about 18 650 people were employed in fishing (excluding fish farming), representing a decline of 8 percent compared with 2000 and almost 20 percent compared with five years before. The largest decline has occurred in fishing as a main occupation, which accounts for more than 75 percent of the total. In Iceland, average employment in fisheries was fairly stable in the five years to 2002, although there were seasonal variations; however, the share of fishing and fish processing – where the majority of workers are women – as a source of employment, dropped to 8 percent in 2002 from 10 percent five years earlier. In Japan, the numbers of marine fishery workers

[6] The members of the European Union prior to 1 May 2004: Austria, Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Luxembourg, the Netherlands, Portugal, Spain, Sweden and the United Kingdom.

Table 7
World fishers and fish farmers by continent

	1990	1995	2000	2001	2002
			(thousands)		
Total					
Africa	1 917	2 238	2 585	2 640	2 615
North and Central America	767	770	751	765	762
South America	769	814	784	760	770
Asia	23 654	28 552	30 770	31 493	32 821
Europe	654	864	821	796	746
Oceania	74	76	86	80	81
World	**27 835**	**33 314**	**35 797**	**36 534**	**37 795**
Of which fish farmers[1]					
Africa	...	105	112	115	111
North and Central America	53	74	74	69	65
South America	16	88	92	92	93
Asia	3 698	6 003	8 503	8 720	9 502
Europe	11	36	37	39	39
Oceania	neg.	1	5	5	5
World	**3 778**	**6 307**	**8 823**	**9 040**	**9 815**

[1] Data for 1990 and 1995 were reported by only a limited number of countries and therefore are not comparable with those for the following years.
neg. = negligible; ... = data not available.

has been falling yearly since 1991, reaching a low of 243 320 people in 2002. The vast majority (72 percent) of these fishers were self-employed workers, as is commonly the case in the fishery profession.

The fishing workforce in most developed economies is advancing in age, mainly because of the profession's decreasing attractiveness to younger generations. For instance, in Japan, 95 750 male fishers (or 47.2 percent of the total) were 60 years of age or older in 2002. The share of this age class has recently been increasing at a rate of 1 percent per year and in 2002 was nearly 25 percent above the figure of 20 years previously. By comparison, the younger group of workers (under 40 years of age), which represented one-quarter of the total number of marine fishery workers in 1982, had decreased to 12.1 percent of the 243 320 people engaged in marine fishery by 2002.

Complete data on the numbers of aquaculture workers worldwide are not available. The partial statistics that are available indicate an increase of about 8 percent per year since 1990, with part of the increase accounted for by improved reporting by countries. Since 2000, however, in many developed countries, figures on employment in aquaculture indicate that a levelling-off has started to occur, owing to a parallel slowdown of the rate of growth of farmed fish and shellfish production. After peaking in 1995, then decreasing for several years, employment in fish farming in Norway has been stable since 1998. In 2002, 3 457 people were employed, one-third of whom worked in hatcheries; men (accounting for 90 percent of the total) are employed mainly in salmon and trout production, while female workers, whose employment has been stable for many years, are largely employed in the production of fry and fingerlings rather than fish for consumption.

In countries where fishing and aquaculture are less prominent in the economy, comparative employment and income statistics at this level of detail are often not easily available. In many developing countries, which have the largest number of

Table 8
Number of fishers and fish farmers in selected countries

Country	Fishery		1990	1995	2000	2001	2002
WORLD	FI + AQ	(number)	**27 835 441**	**33 314 345**	**35 796 679**	**36 534 194**	**37 795 203**
		(index)	***78***	***93***	***100***	***102***	***106***
	FI	(number)	…	…	26 974	27 494	27 980
		(index)	…	…	100	102	104
	AQ	(number)	…	…	8 823	9 040	9 815
		(index)	…	…	100	102	111
China	FI + AQ	(number)	9 092 926	11 428 655	12 233 128	12 944 046	12 337 732
		(index)	74	93	100	106	101
	FI	(number)	7 352 827	8 759 162	8 510 779	9 097 276	8 377 036
		(index)	86	103	100	107	98
	AQ	(number)	1 740 099	2 669 493	3 722 349	3 846 770	3 960 696
		(index)	47	72	00	103	106
Indonesia	FI + AQ	(number)	3 617 586	4 568 059	5 247 620	5 477 420	5 662 944
		(index)	69	87	100	104	108
	FI	(number)	1 995 290	2 463 237	3 104 861	3 286 500	3 392 780
		(index)	64	79	100	106	109
	AQ	(number)	1 622 296	2 104 822	2 142 759	2 190 920	2 270 164
		(index)	76	98	100	102	106
Japan	FI + AQ	(number)	370 600	301 440	260 200	252 320	243 320
		(index)	142	116	100	97	94
Peru[1]	FI + AQ	(number)	43 750	62 930	66 361	66 382	66 502
		(index)	66	95	100	100	100
Norway	FI + AQ	(number)	27 518	28 269	23 729	22 637	22 105
		(index)	116	119	100	95	93
	FI	(number)	27 518	23 653	20 098	18 955	18 648
		(index)	137	118	100	94	93
	AQ	(number)	…	4 616	3 631	3 682	3 457
		(index)	…	127	100	101	95
Iceland	FI	(number)	6 951	7 000	6 100	6 000	6 000
		(index)	114	115	100	98	98

Note: FI = fishing, AQ = aquaculture; index: 2000 = 100; … = data not available.
[1] Data for Peru exclude inland fishers and fish farmers.

fishers, the spouses and families of fishers are occupied in coastal artisanal fisheries and associated activities. Reliable estimates of the number of people engaging in fishing on a part-time or occasional basis, or undertaking rural aquaculture as unpaid family workers, are difficult to obtain. As a consequence, the socio-economic importance of these activities is more difficult to measure, although their contribution to production and income, and to food security for coastal and rural communities, is substantial.

In the absence of other economic data, it is not possible to draw firm global conclusions on current trends from these numbers. Economics still makes fishing an attractive profession for many people in some areas. In China, where it is estimated that 25 million people work in the fish capture industry, in fish farming and in associated processing industries, the economic attraction is demonstrated by the fact that a large percentage of fishers are not local people but migrant workers from inland areas or neighbouring provinces. Part-time fishers might work seasonally in fishing and return to their village during the summer, or undertake a mix of agriculture and fish farming. The average earnings from fishing can offer higher incomes than those from agricultural farming, although jobs in manufacturing and other economic sectors, generally offer higher compensation than those in agriculture and fishing.

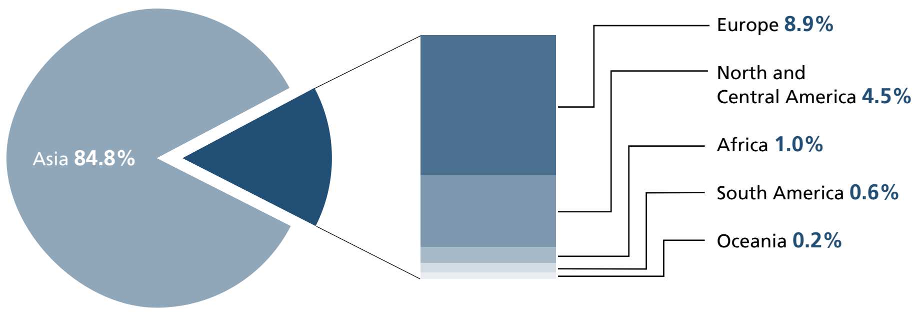
THE STATUS OF THE FISHING FLEET

After years of expansion of the world fishing fleet until the late 1980s and early 1990s, the number of decked vessels worldwide has remained fairly stable at around 1.3 million. In addition, the world fleet engaged in fishing in marine and inland waters comprised about 2.8 million undecked vessels, 65 percent of which were not powered. About 85 percent of total decked vessels, 50 percent of powered undecked vessels and 83 percent of total non-powered boats were concentrated in Asia. The remaining 15 percent of the world's total decked fishing vessels were accounted for by Europe (8.9 percent), North and Central America (4.5 percent), Africa (1 percent), South America (0.6 percent) and Oceania (0.2 percent) (Figure 14). Countries in North and Central America had 21 percent of the open fishing vessels with engines; Africa had 16 percent, South America 6 percent, and Oceania 3 percent.

The aggregate gross tonnage (GT) of large marine fishing vessels (considered to be those above 100 gross tons) increased to a peak of 15.6 million GT in 1992 (24 074 vessels) and has subsequently declined.[7] However, the number of these vessels increased gradually until 2001 and has remained relatively stable, at around 24 000 vessels, in recent years (Figure 15). In 2002, the number of large vessels increased slightly to 24 406 vessels; and has fluctuated around that number until 2004. However, since 1992 the total tonnage of this fleet has contracted as many countries began to adopt programmes of capacity containment. In 2003, the Russian Federation had the highest fleet capacity measured in GT (24 percent of the total GT), followed by Japan and the United States (7 percent each), Spain (6 percent), Norway (3.5 percent) and Ukraine (3 percent). Two open register countries, Panama and Belize, accounted for 6 percent and vessels of unknown flag made up 4.4 percent of the total GT.

Figure 14

Distribution of decked fishing vessels by continent



[7] Indicators of trends in the large marine fishing vessel fleet (above 100 GT) are based on data from Lloyd's Maritime Information Services (LMIS). It should be noted that only a small proportion (443 vessels) of the Chinese fleet of about 15 000 vessels over 24 metres length overall (LOA) reported by China to the International Maritime Organization (IMO) pursuant to the Torremolinos Agreement are included in the LMIS. It should also be noted that changes in the measurement of tonnage (from gross registered tonnage [GRT] to GT) requires caution in interpretation of trends in fleet tonnage.

The average age of the larger marine fishing vessel fleet segment has continued to increase. Whereas in 1992 about 30 percent of vessels were less than ten years old and 6 percent were more than 30 years old, in 2003 these percentages were 13 percent and 28 percent respectively. Figure 16 shows the age profile of the global fleet in 2003. Of the national fleets over 200 000 GT, the Japanese fleet is the youngest (average age 16 years), while the Republic of Korea's fleet is the oldest (average age 29 years). France and Vanuatu have relatively young fleets (average age 19 and 8 years, respectively), while the fleets of Ghana, the Philippines, Senegal and South Africa all have an average age of over 30 years.

Fishing is considered to be one of the most dangerous occupations. The aging fishing fleet raises concerns over the safety of both vessels and crew. Furthermore, standards of accommodation and other conditions for the crew on board these very

Figure 15

Global fleet above 100 GT recorded in the Lloyd's Maritime Information Services database

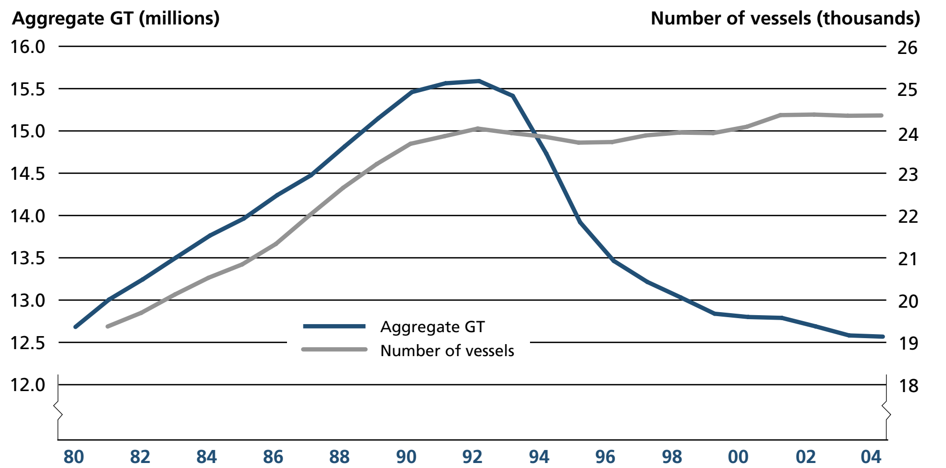
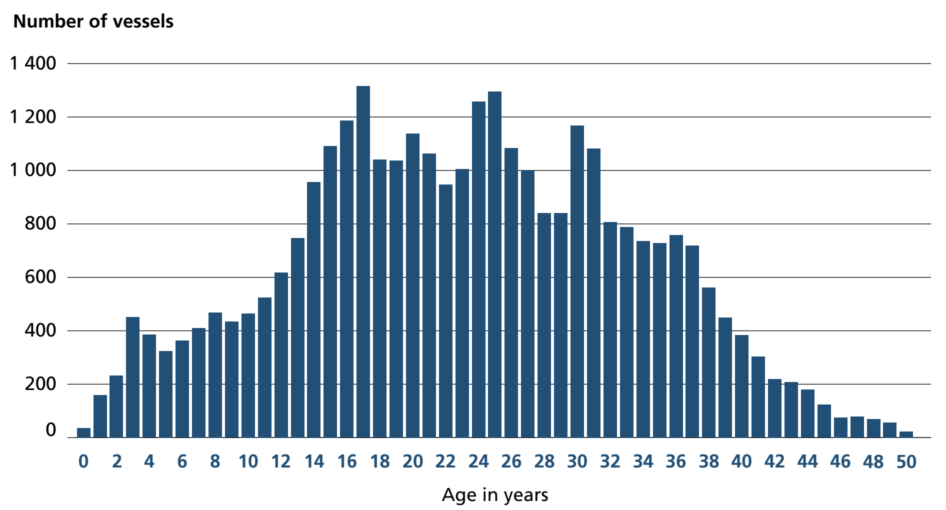


Figure 16

Age profile of global fleet above 100 GT in 2003



old vessels often do not conform to current minimum requirements for newly built vessels.

The slowdown in new construction of larger vessels suggests that improvements in safety and conditions may also be slow. While it is clear that capacity management plans may require some reduction in the fleet of large vessels, it is also clear that there will always be a need for larger vessels for fishing in distant waters and in bad weather conditions. In addition, many offshore pelagic fisheries tend to be more economically feasible when operating with larger vessels. It is expected that the construction of larger fishing vessels will increase over the next ten years, compared with the current low levels. In this context it may be noted that the International Labour Organization (ILO) is currently establishing a new Convention on labour conditions in the fishing industry (which includes accommodation standards for a new fishing fleet) (see Part 2, pp. 74–76). FAO, the ILO and the International Maritime Organization (IMO) are also finalizing a major revisions of the Code of Safety for Fishermen and Fishing Vessels and of the Voluntary Guidelines for the Design, Construction and Equipment of Small Fishing Vessels.

Although detailed indications of trends in the entire fishing fleet are not available on a global scale after 1998, the fleet size of some major fishing nations has continued to decrease. The European Union (EU-15) fishing fleet decreased from 96 000 vessels in 2000 to 88 701 in 2003. Of the total fleet, 13 percent were trawlers, 6 percent seiners, 33 percent gillnetters, 16 percent longliners, and the remainder operated other gear. Of the 87 833 vessels of known length, slightly over 80 percent measured less than 12 metres, the majority of these belonging to Greece, Italy and Spain. Some 15 percent of EU fishing vessels were between 12 and 24 metres in length, and fewer than 340 measured more than 45 metres (a decrease of 60 units compared with five years earlier). In December 2002, Norway had a registered fleet of 7 802 engine-driven decked fishing vessels and 2 847 open vessels. Comparative statistics indicate a further decrease of 628 units (8 percent) for the decked fleet since 2000, and a decrease of nearly 40 percent in the number of open vessels. At the end of 2003, the Icelandic fleet had 1 872 vessels on register, 50 percent of which were undecked; this implies 63 units fewer than in 2002 and a decrease of about 7 300 in GT. Nearly 40 percent of the trawlers (about 75 percent of all decked vessels) are more than 20 years old. In New Zealand, whose exclusive economic zone is one of the largest in the world, the number of domestic commercial fishing vessels numbered 1 700 in 2001 and these were complemented by 36 foreign chartered vessels; these figures represent a decrease of 1 102 domestic vessels and 43 chartered vessels compared with 1992.

Over 90 percent of the Japanese fleet are vessels below 5 gross tons. All segments of the fleet declined between 1997 and 2001; in particular, the number of vessels greater than 50 gross tons (fewer than 1 percent in 2001) decreased by over 20 percent.

Important advances have been made by several RFBs[8] through the establishment of lists of "positive" (authorized to fish in the area of the RFBs' jurisdiction) and "negative" (unauthorized, or "non-cooperating") vessels in order to improve the monitoring and control of fisheries on the high seas and transboundary stocks. Other RFBs[9] are in various stages of establishing such lists, and some countries and non-governmental organizations (NGOs) have initiated lists of vessels reported to be engaged in unauthorized fishing.

As of mid-2004, 5 517 vessels are recorded in the High Seas Vessels Authorization Record maintained by FAO. Only 19 countries[10] out of 30 parties to the Compliance

[8] These include the Commission for the Conservation of Antarctic Marine Living Resources (CCAMLR), Forum Fisheries Agency (FFA), International Commission for the Conservation of Atlantic Tunas (ICCAT), Indian Ocean Tuna Commission (IOTC), Inter-American Tropical Tuna Commission (IATTC), Northwest Atlantic Fisheries Organization (NAFO) and North East Atlantic Fisheries Commission (NEAFC).

[9] Sub-Regional Fisheries Commission (West Africa), Western Central Pacific Fisheries Commission, and Commission for the Conservation of the Southern Bluefin Tuna

[10] Benin, Canada, Japan, Namibia, Norway, United States and 13 EU countries (Belgium, Denmark, Finland, France, Germany, Greece, Ireland, Italy, Netherlands, Portugal, Spain, Sweden, United Kingdom).

Table 9
Fishing vessels of 100 GT and above: new building, flagging in and out of shipping registers and scrappings and losses in 2003

	New building	Flagging out	Flagging in	Scrappings and losses	Change
Selected country register					
Belize	5	178	81	0	–92
Equatorial Guinea	0	17	4	0	–13
Honduras	0	16	15	0	–1
Iceland	1	33	11	2	–23
Japan	0	138	1	3	–140
Namibia	1	10	16	0	7
Netherlands	9	22	1	13	–25
Norway	28	29	11	31	–21
Panama	2	21	33	0	14
Russian Federation	7	50	82	3	36
Saint Vincent and the Grenadines	0	38	7	1	–32
South Africa	2	3	29	1	27
Spain	64	13	1	25	27
United Kingdom	18	38	8	65	–77
United States	21	59	3	12	–47
Unknown	2	0	242	0	244
Subtotal	**160**	**665**	**545**	**156**	**–116**
All country registers	**384**	**916**	**916**	**347**	**37**

Note: Changes to the database of Lloyd's Maritime Information Services (for fishing vessels).

Agreement[11] have supplied FAO with the required information on vessels authorized to fish on the high seas.

Work in progress in FAO suggests that there is overcapacity in the world's industrial tuna fishing fleets.[12] In this context, a moratorium on construction has been considered in conjunction with the development of mechanisms for the smooth transfer of capacity from distant-water fishing nations to coastal developing states.

An analysis of the fishing vessels that changed their flag state in 2003 (Table 9) suggests continued high activity in "flag of convenience" countries, although there are indications that the number of such vessels are decreasing. Belize, Equatorial Guinea and Saint Vincent and the Grenadines had substantial fleet reductions, while the Honduras fleet remained relatively unchanged and the Panama fleet increased by 14 vessels, when new built vessels and scrapping is taken into account.

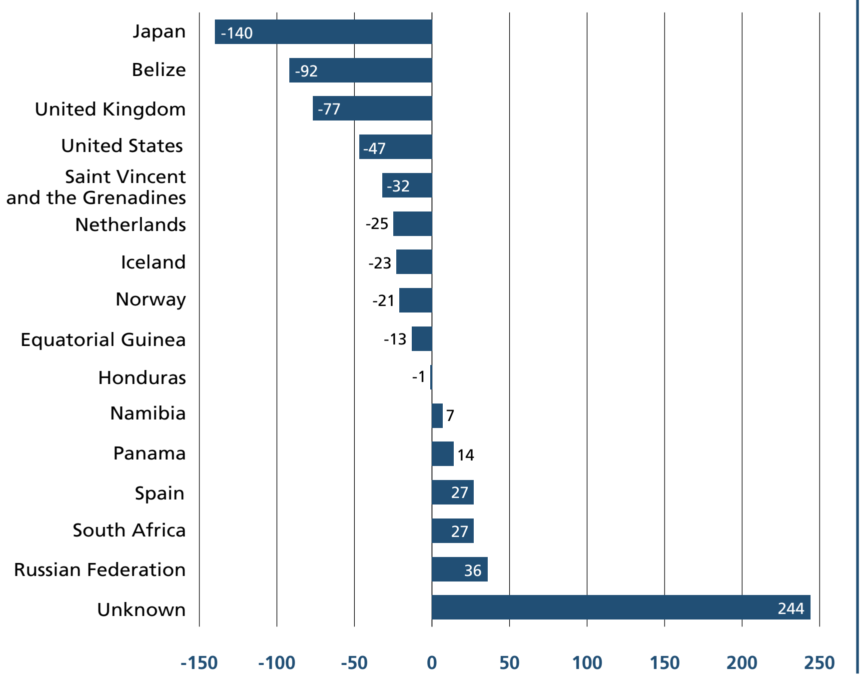
In 2003, several of the major fishing nations appeared to be substantially reducing their numbers of vessels of 100 GT and above by flagging out (Figure 17). Japan was foremost, with a total reduction of 140 vessels. Iceland, the Netherlands, Norway, and the United States all flagged out more vessels than they have flagged in. The United Kingdom has substantially reduced its fleet by scrapping older vessels and flagging out.

[11] The Agreement to Promote Compliance with International Conservation and Management Measures by Fishing Vessels on the High Seas was adopted by the FAO Conference in November 1993 and came into force in 2003. For further information, see http://www.fao.org/Legal/treaties/012t-3.htm; accessed September 2004.

[12] Management of Tuna Fishing Capacity: Conservation and Socio-economics. FAO Project GCP/INT/851/JPN.

Figure 17

Change in numbers of fishing vessels of 100 GT and above in selected fleets, 2002–03



Spain, on the other hand, has substantially increased its fleet by building new vessels. Vessels flagging out to the "unknown" category account for more that 25 percent of those reflagging.

The Lloyd's Register records 1 213 "unknown flag" vessels over 100 gross tons and considered to be still in operation in 2003 (records before 1970 excluded). Of the vessels for which records of the previous flag exists, 51 percent were flagged in one of the following countries: Belize, Equatorial Guinea, Honduras, Panama, Saint Vincent and the Grenadines, and Vanuatu, and 56 percent of these vessels were constructed either in Japan or Taiwan Province of China.

THE STATUS OF FISHERY RESOURCES

Marine fisheries

After increasing from around 79 million tonnes in 1998 to 87 million tonnes in 2000, world marine capture fisheries production decreased to around 84 million tonnes in 2001 and remained at that level in 2002. The decrease of around 2.5 percent in global catches between 2000 and 2002 is mostly due to the declines by 12 percent and 7 percent, respectively, in production from the Southeast Pacific and the Northwest Pacific.

The Northwest Pacific is the most productive fishing area of the world, with nominal catches oscillating between 20 and 24 million tonnes (including China) since the late 1980s (Figure 18). Large catch fluctuations in the area are mainly driven by fisheries for the abundant stocks of Japanese pilchard (or sardine) and Alaska pollock. Both stocks show a declining trend since the late 1980s as a result of the combined effects of overfishing and environmental factors affecting stock productivity. Although there has been an increase in catches of other species, including the Japanese anchovy, it was not enough to compensate for the decline in pilchard/sardine and pollock and to offset the consistent decline in fisheries production in the area of around 3 percent per year since 1998.

In the Southeast Pacific, three species account for around 80 percent of total catches: the Peruvian anchoveta, the Chilean jack mackerel and the South American pilchard (or sardine). Large catch fluctuations are common in the area as a consequence of periodic climatic events associated with the El Niño Southern Oscillation affecting fishing success and stock productivity. For instance, catches of Peruvian anchoveta dropped severely following the adverse El Niño environmental conditions in 1997–98. More favourable climatic conditions in 2000 led to one of the highest catches on record, of around 11 million tonnes, but in 2002 the fishery for Peruvian anchoveta declined to 9.7 million tonnes, causing a net decrease in total fisheries production in the area.

The remaining fishing areas of the Pacific have exhibited increasing trends in catches since 2000. In the Northeast Pacific, fisheries production had been declining since its peak of 3.6 million tonnes in 1987, but made a slight recovery to 2.7 million tonnes in 2001 and 2002. Alaska pollock is the single most important stock in the Northeast Pacific and accounts for most of the fluctuation in total catches. In the Western Central Pacific, fisheries production has been growing steadily since 1950, reaching close to 10 million tonnes in 2001. In the Eastern Central Pacific, total catches have fluctuated between 1.2 and 1.8 million tonnes since 1981. The recent production increase in the area has been influenced by the California pilchard (or sardine), which yielded about 670 000 tonnes in 2001 and 2002 – the highest recorded catch of the species since 1950. Nominal catches in the Southwest Pacific reached a peak of 917 000 tonnes in 1992 and gradually declined to 714 000 tonnes in 2000 before making a slight recovery.

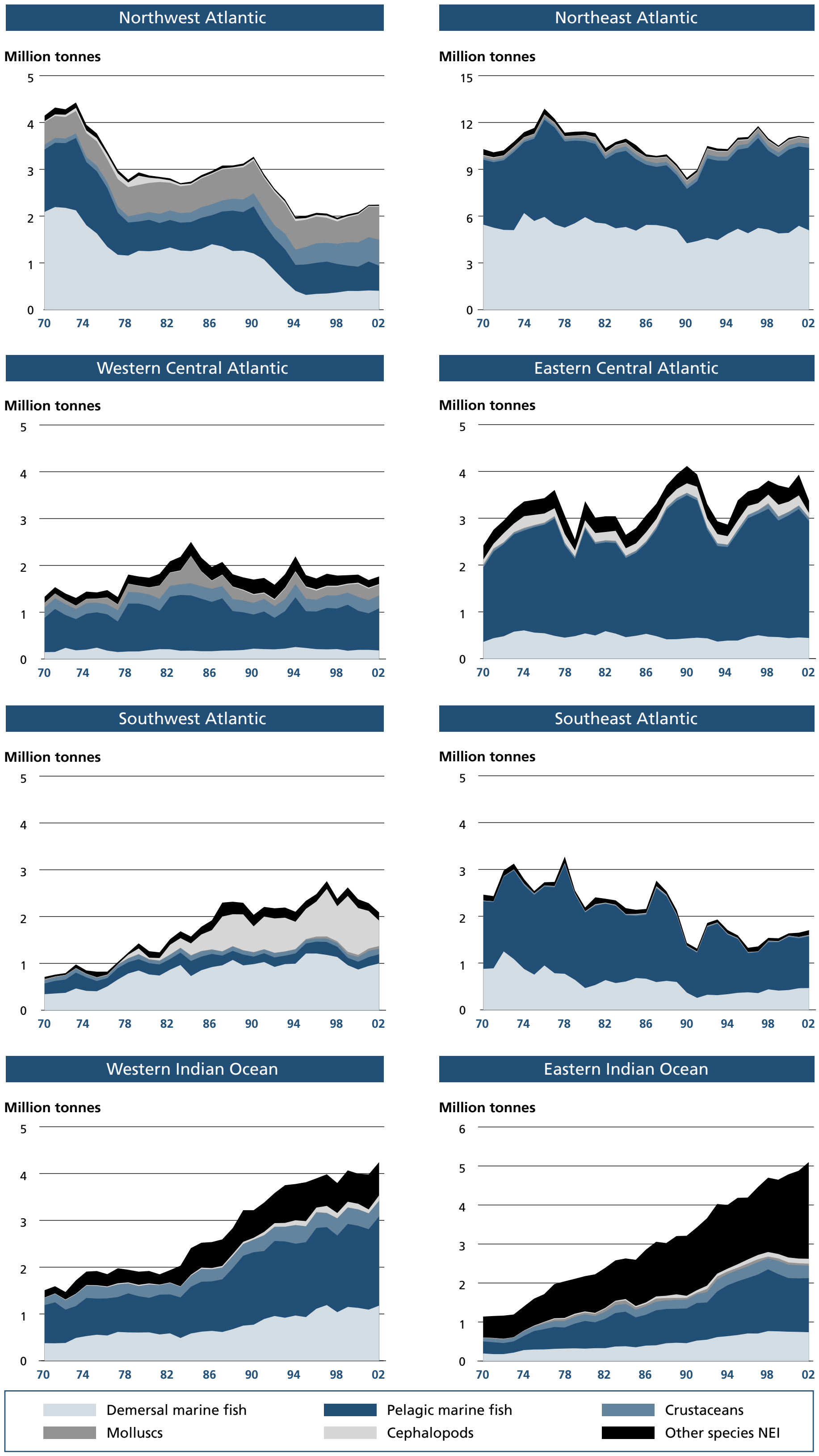
In the Atlantic, catches have increased in the Northwest and Southeast fishing areas. Northwest Atlantic fisheries production reached its lowest level in 1994 and again in 1998 with the collapse of groundfish stocks off Eastern Canada. Catches have since been increasing slowly, from close to 2 million tonnes in 1994 to 2.26 million tonnes in 2002. In the Southeast Atlantic, catches have followed an increasing trend since 1996, with the growth mostly accounted for by small pelagic fish, and reached close to 1.7 million tonnes in 2002. Fluctuations in catch are common in the area in response to the substantial environmental variability of the Benguela Current system. In other areas, such as the Southwest and Eastern Central Atlantic, there has been a noticeable decline in fisheries production since 2000. The 7 percent decrease in total catches in the Eastern Central Atlantic falls within the pattern of catch fluctuation from 2.9 to 4.1 million tonnes observed in the region since 1990. This is a consequence of the combined effect of changes in distant-water fishing effort and environmentally induced changes in the productivity of the abundant small pelagic stocks. In the Southwest Atlantic, the decline in catches can largely be attributed to the fall of around 45 percent in the catches of Argentine shortfin squid from 2000 to 2002. This species made up 33 percent of the total catches in the Southwest Atlantic in 2001 and squid catches have been declining since 1999, when around 1.1 million tonnes were reported.

Monitoring the status of fisheries in the Indian Ocean has been difficult because of a generally poor system of fisheries statistics collection in the region, reflected in the relatively high proportion of catches reported as "miscellaneous marine fishes" in the official statistics. This is also a significant problem in other areas, such as the Southwest, Eastern and Western Central Atlantic and the Northwest and Western Central Pacific. However, both the Western and Eastern Indian Ocean areas show a continuing increase in total reported catches, with fisheries production in 2002 being the highest on record for both areas.

Fisheries production in the high seas is considerably higher in the Pacific, followed by the Atlantic and the Indian Oceans. Tunas comprise the single most important resource exploited in the high seas. In some areas of the Atlantic and Pacific, straddling stocks of jack mackerel and squids and demersal fish on seamounts contribute significantly to production. The contribution of sharks to the total reported catches is minor compared with that of other oceanic resources; moreover, bycatch underreporting and discards are a source of concern when dealing with this species group. The world catches of the seven principal market species of tunas increased from less than 0.5 million tonnes in the early 1950s to a peak of 4 million tonnes in 2002,

Figure 18

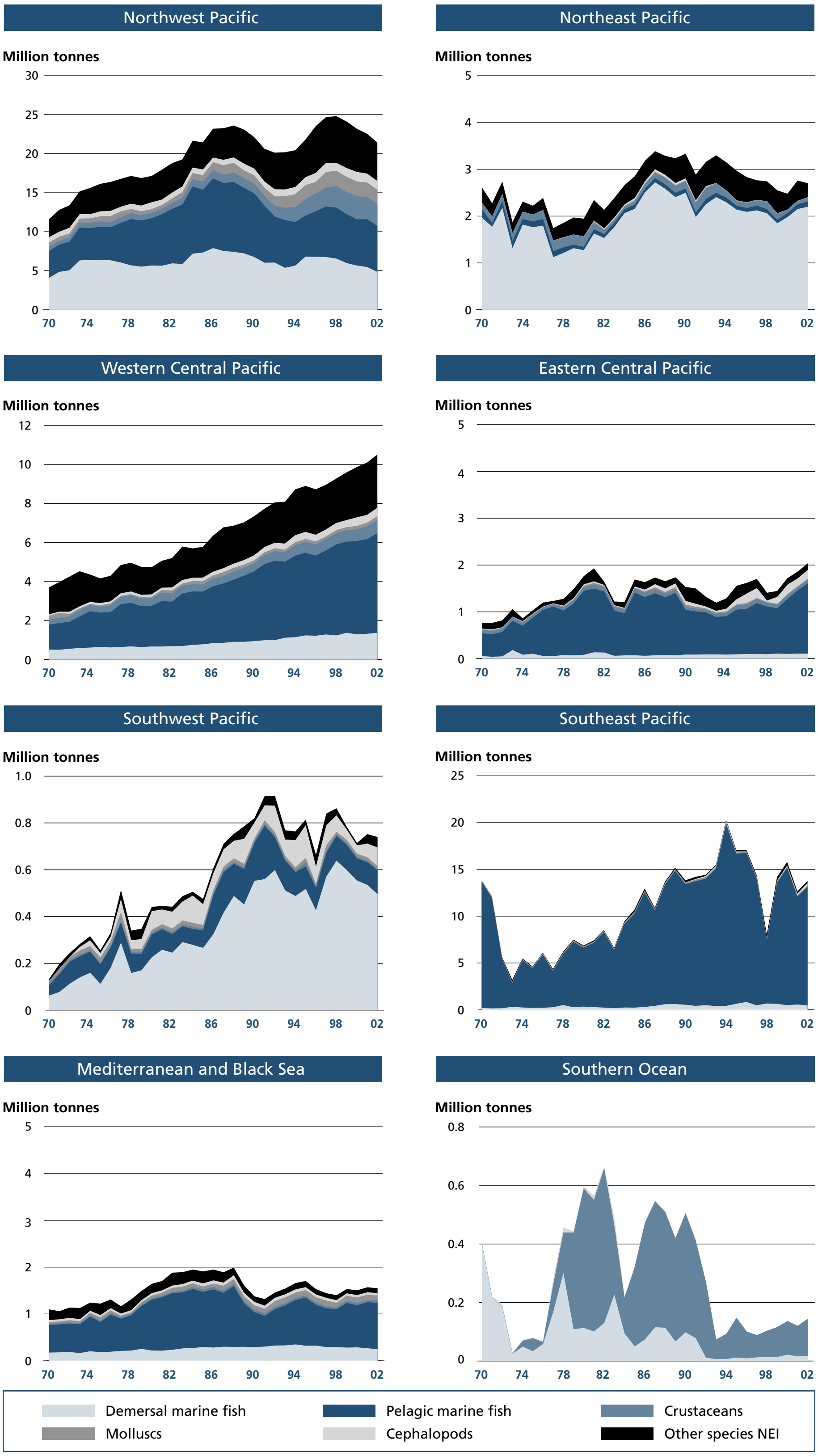
Capture fisheries production in marine areas



(Continued)

Figure 18 *(cont.)*

Capture fisheries production in marine areas



Notes: Data exclude aquatic plants and catches of marine mammals, sponges and corals, etc.
NEI = not elsewhere included.

with a tendency to stabilize since 1998. Skipjack tuna accounts for about 50 percent of this total, with a reported catch of 2 million tonnes, and remains one of the top species in world fisheries production.

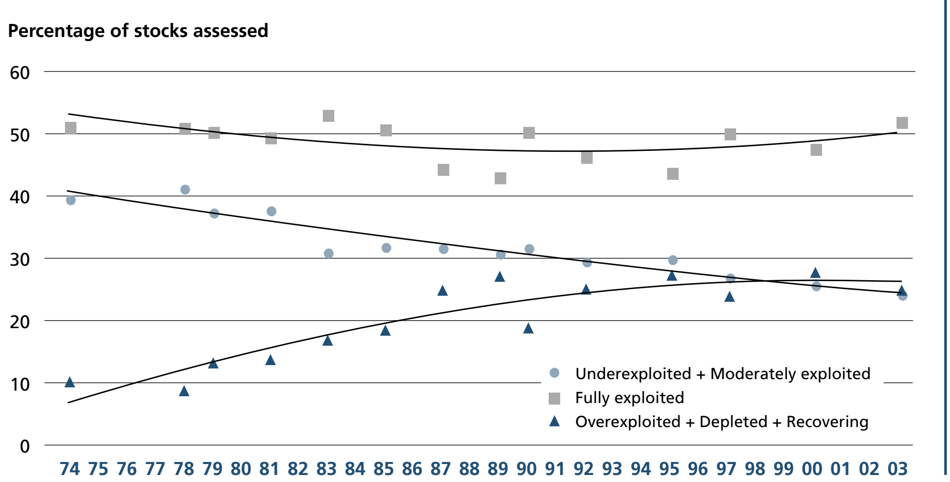
A recurring pattern in some areas is a long-term change in catch composition following the depletion of more traditional stocks and the targeting of other less-valuable and previously lightly exploited or non-exploited species (Figure 18). For instance, in the Northwest Atlantic invertebrate catches (molluscs and crustaceans) have increased and those of demersal fish have declined. In the Northeast Atlantic, the continuous decline in cod catches since the late 1960s has been counterbalanced by increasing catches of formerly low-valued fish species such as blue whiting and sand eels. In the Southwest Atlantic, the decline of the Argentine hake has been accompanied by an increasing trend in catches of shortfin squid. The decline in catches of pilchard (or sardine) and pollock in the Northwest Pacific has been partially compensated for by increases in catches of Japanese anchovy, largehead hairtail and squids. These changes in the species composition of fisheries catches can have different causes, including the adaptation of the industry and markets to resources previously considered as low-value, the effect of fisheries on the structure of marine communities, and changes in environmental regimes affecting the stock productivity. These effects are often difficult to discern, particularly in areas where research and monitoring of resources and environment processes are poorly developed.

FAO monitors the state of exploitation of the main fish stocks or groups of resources for which assessment information is available. The current global situation follows the general trend observed in previous years. It is estimated that in 2003 about one-quarter of the stocks monitored were underexploited or moderately exploited (3 percent and 21 percent respectively) and could perhaps produce more. About half of the stocks (52 percent) were fully exploited and therefore producing catches that were close to their maximum sustainable limits, while approximately one-quarter were overexploited, depleted or recovering from depletion (16 percent, 7 percent and 1 percent respectively) and needed rebuilding. From 1974 to 2003 there was a consistent downward trend in the proportions of stocks offering potential for expansion. At the same time there was an increasing trend in the proportion of overexploited and depleted stocks, from about 10 percent in the mid-1970s to close to 25 percent in the early 2000s (Figure 19).

Of the top ten species that account in total for about 30 percent of the world capture fisheries production in terms of quantity (Figure 6, p. 9), seven correspond to stocks that are considered to be fully exploited or overexploited (anchoveta, Chilean

Figure 19

Global trends in the state of world marine stocks since 1974



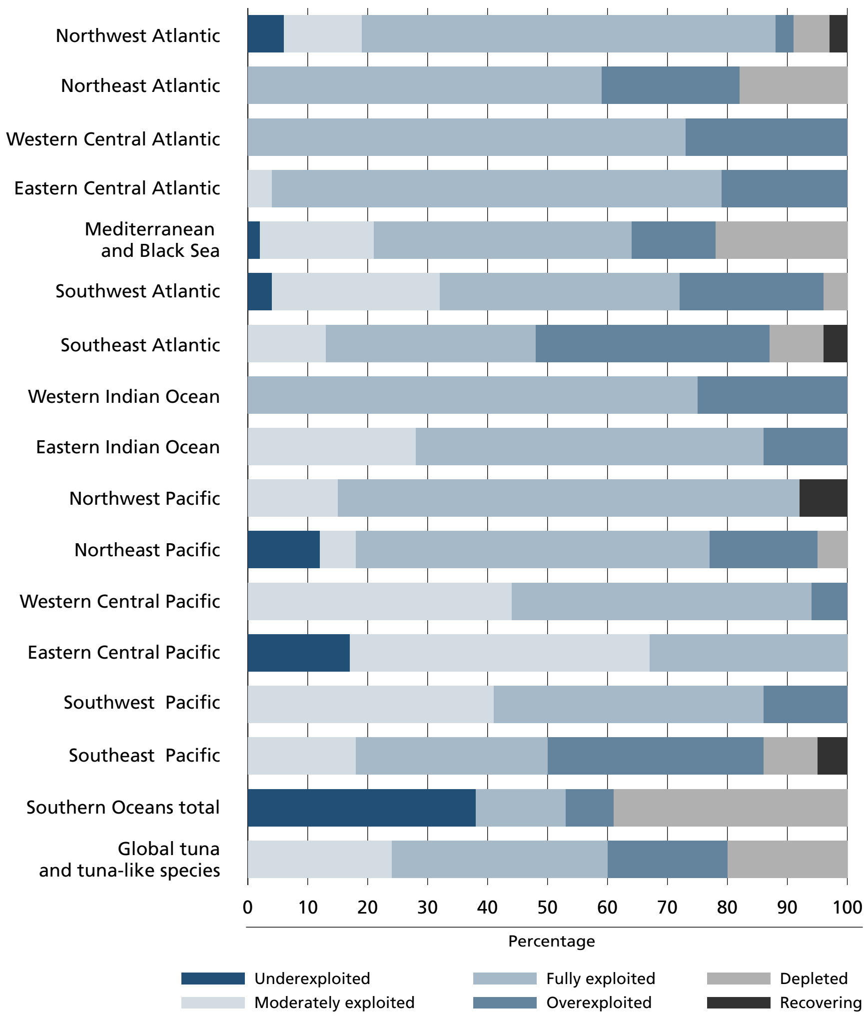
jack mackerel, Alaska pollock, Japanese anchovy, blue whiting, capelin and Atlantic herring). Major increases in catches cannot therefore be expected from these. Two species could probably support higher fishing pressure in some areas (skipjack tuna and chub mackerel) and the status of the remaining species (largehead hairtail) is unknown.

In the Southeast Pacific, a combination of high fishing pressure and adverse environmental conditions, including the severe El Niño event of 1997–98, led to a sharp decline in catches of the two leading species (anchoveta and Chilean jack mackerel) during the late 1990s. While the stock of anchoveta has shown signs of recovery, with catches in the order of 10 million tonnes since 2000, catches of Chilean jack mackerel totalled 1.7 million tonnes in 2002, representing less than 50 percent of the fishery's historical peak production reached in 1994. In the North Pacific large changes in catches occurred in response to heavy fishing and to natural decadal oscillations in the productivity of pilchard (or sardine), anchovy and pollock. Following record catches in the 1980s, the Japanese sardine (or pilchard) fishery collapsed in the mid-1990s and was followed by a strong rebuild of the anchovy population, which has been supporting catches of close to 2 million tonnes since 1998. This alternation between sardine and anchovy stocks follows a pattern observed in many other regions of the world and seems to be mainly governed by climatic regimes affecting stock production. The stocks of pollock in the Northwest Pacific are considered overexploited, while those in the Northeast Pacific are considered fully exploited. Pollock catches peaked in the late 1980s in both areas and have been declining since then, although a recent modest recovery is evident in the Northeast Pacific. In the Northeast Atlantic, catches of blue whiting reached record levels (1.8 million tonnes) in 2001 and declined slightly in 2002. The stock is currently under heavy fishing and requires more restrictive management measures. Capelin and herring are exploited to their full potential and are currently considered within safe biological limits. Catches of skipjack tuna have increased steadily since 1950 and reached their highest reported value of around 2 million tonnes in 2002, representing about half of the total capture of market tunas. The status of skipjack tuna stocks is highly uncertain but there are indications that some potential remains for increases in catches in the Eastern, Western and Central Pacific and in the Indian Ocean, provided that these increases in skipjack catches will not lead to parallel increases in catches of other species that are presently fully exploited or overexploited, for example bigeye and yellowfin tunas.

The percentage of stocks exploited at or beyond their maximum sustainable levels varies greatly by area. In the Eastern Central Pacific, only 33 percent of the stocks for which assessment information is available are recorded as fully exploited, with the remainder being either underexploited or moderately exploited, whereas in the Western Central and Northeast Atlantic and the Western Indian Ocean, all the stocks for which information is available are reported as being fully exploited (73 percent, 59 percent and 75 percent respectively) or as being exploited beyond this level (Figure 20). In 12 of the 16 FAO statistical regions at least 70 percent of stocks are already fully exploited or overexploited, suggesting that that the maximum fishing potential has been reached and that more cautious and restrictive management measures are needed. This conclusion is also supported by analysis of the trend in fisheries production of the regions. Four of the 16 regions are at their maximum historical level of production, while in 12 regions production has declined slightly and in four the declines have been sharper, including the Northwest Atlantic (50 percent decline from a peak in 1968), Southeast Atlantic (47 percent decline from a peak in 1978) and Southeast Pacific (31 percent decline from a peak in 1994). In most cases overfishing has been a main contributory factor and in some cases this has been associated with adverse or highly variable environmental conditions. All the information available tends to confirm the estimates made by FAO in the early 1970s that the global potential for marine capture fisheries is about 100 million tonnes, of which only 80 million tonnes are probably achievable. It also confirms that, despite local differences, overall, this limit has been reached. These conclusions lend support to the call for more rigorous stock recovery plans to rebuild stocks that have been

Figure 20

State of exploitation of marine fishery resources



depleted by overfishing and to prevent the decline of those being exploited at or close to their maximum potential.

In response to worldwide public concerns, countries have been promoting, through FAO and the World Summit on Sustainable Development held in Johannesburg, South Africa, in 2002, an extension of the usual policies and management focus from single fishery stocks to ecosystems. This implies an increasing demand for better understanding and monitoring of a wide range of processes affecting or affected by fisheries. Some of the most important management concerns today are the effects of fisheries on habitats, marine communities, and ecological interactions (such as predator–prey relationships), as well as the those of land-based activities and climatic changes on fisheries. The lack of selectivity in many fisheries, which leads to bycatch and discards (the unintended catch of non-targeted species and their subsequent discarding) is an additional management concern. Bycatch may increase fishing pressure on resources targeted by other fisheries, possibly aggravating overfishing, and can also have undesirable impacts on endangered and protected species such as sea turtles and certain species of marine mammals, sea birds and sharks. Discards of inedible, non-commercial, or undersized species and individuals represent collateral damage to the ecosystem, a waste of resources and an additional source of overfishing (see pp. 122–127).

Coastal development (including urban and industrial expansion and aquaculture) and industrial activities in the hinterland also pose many threats to the health of marine ecosystems when they pollute and degrade critical coastal habitats. These land-based and coastal alterations adversely affect the livelihoods of coastal fishing communities and industries, for example through a reduction of the sustainable yield of fish stocks; modification of the resource species composition, health and diversity; an increase in ecosystem instability and variability and a reduction of seafood quality and safety. Periodic climatic phenomena such as El Niño can have a drastic impact on fish populations and lead to the collapse of fisheries (e.g. the Peruvian anchoveta in the Southeast Pacific in the early 1970s). Over the longer term, many fish stocks follow decadal fluctuations that seem to respond to natural climatic cycles. The effect of climate on fisheries is exacerbated in a situation of overfishing, when both fish stocks and fishing industries become more vulnerable to the natural dynamics of the environment. The assessment of these and other ecosystem–fisheries interactions is still in its infancy and much more needs to be known about their effects on fishery resources, fishing communities and industries, their causes and trends, and how to deal with and adapt to them. The state of fishery resources and their ecosystems, however, allows little room for delay in the implementation of measures that should have been taken in the last three decades. Therefore the precautionary approach to fisheries, recommended by UNCED, the United Nations Fish Stocks Agreement[13] and the FAO Code of Conduct for Responsible Fisheries[14] needs to be implemented in practice.

Inland fisheries

Unlike the major marine fish stocks, inland fish stocks are less well defined and occur over much smaller geographical areas, such as individual lakes, rice fields or rivers, or over vast areas such as transboundary watersheds that are often situated in areas that are difficult to access. These factors make it costly to monitor the exploitation and status of fish stocks and, in fact, very few countries can afford to do so. As a result, the majority of countries report only a small fraction of their catch of inland fisheries by species, further compounding the problem of accurate assessment. Thus FAO is not in a position to make global statements on the status of these resources.

It was reported in *The State of World Fisheries and Aquaculture 2000* that inland fishery resources are undervalued and under threat from habitat alteration, degradation and unsustainable fishing activities. This trend unfortunately appears to be continuing. LARS 2, a recent symposium on managing the fisheries of large rivers,[15] noted that the availability of global information on river fisheries is poor, that over 50 percent of inland fish species occur in rivers and that rivers contain a higher proportion of organisms classed as endangered or threatened than do most other ecosystems. Many river basins, especially in developing countries, support intensive fisheries and in many cases catches have increased, although changes in their species composition have occurred as catches of large and late-maturing species have declined. River fisheries continue to provide substantial catches in developing countries, even in the face of intensive exploitation. However, in the Mekong River, for the first time, there is evidence that stocks are being overfished.[16] Numerous lake fisheries are also

[13] The Agreement for the Implementation of the Provisions of the United Nations Convention on the Law of the Sea of 10 December 1982 relating to the Conservation and Management of Straddling Fish Stocks and Highly Migratory Fish Stocks was adopted and opened for signature in 1995. For further information, see http://www.un.org/Depts/los/convention_agreements/convention_overview_fish_stocks.htm; accessed September 2004.

[14] Adopted by the 28th Session of the FAO Conference in October 1995. For further information, see http://www.fao.org/DOCREP/005/v9878e/v9878e00.htm; accessed September 2004.

[15] Second International Symposium on the Management of Large Rivers for Fisheries: Sustaining Livelihoods and Biodiversity for the New Millennium, Phnom Penh, Cambodia, 11–14 February 2003. For further information, see http://www.lars2.org; accessed September 2004.

[16] C. Barlow, Fisheries Unit, Mekong River Commission, personal communication, April 2004.

showing signs of overexploitation. In Lake Victoria, for example, the Nile perch fishery decreased from a record catch of 371 526 tonnes in 1990 to 241 130 tonnes in 2002. Sturgeon fisheries in the countries surrounding the Caspian Sea have also decreased, from approximately 20 000 tonnes in 1988 to less than 1 400 tonnes in 2002, owing to a combination of illegal fishing, overfishing and habitat degradation. Inland fishes in general have been characterized as the most threatened group of vertebrates used by humans.[17]

Nevertheless, the status of some inland fishery resources has been enhanced in many areas through stocking programmes, the introduction of alien species, habitat engineering and habitat improvement. In many developing areas, especially in Asia, rice fields and irrigated areas are enhanced to increase the production of aquatic biodiversity other than rice, and to improve the nutritional status of rural households.[18] Enhancement can make the resources more stable, easily harvested and valuable.

FISH UTILIZATION

In 2002, about 76 percent (100.7 million tonnes) of estimated world fish production was used for direct human consumption (Table 1, p. 3). The remaining 24 percent (32 million tonnes) was destined for non-food products, in particular the manufacture of fishmeal and oil. If China is excluded, the shares are 74 percent (65.5 million tonnes) and 26 percent (23 million tonnes), respectively (Table 2, p. 4 and Figure 2, p. 5). More than 79 percent (35 million tonnes) of China's reported fish production (44 million tonnes) was apparently used for direct human consumption, the bulk of which was in fresh form (75.5 percent). The remaining amount (an estimated 9.1 million tonnes) was reduced to fishmeal and other non-food uses, including direct feed for aquaculture.

In 2002, 70 percent (62 million tonnes) of the world's fish production, excluding China, underwent some form of processing. Sixty-three percent (39 million tonnes) of this processed fish was used for manufacturing products for direct human consumption and the rest for non-food uses. The many options for processing fish allow for a wide range of tastes and presentations, making fish one of the most versatile food commodities. Yet, unlike many other food products, processing does not generally increase the price of the final product and fresh fish is still the most widely accepted product on the market. During the 1990s, the proportion of fish marketed in live/fresh form worldwide increased compared with other products (Figures 21 and 22). Excluding China, live/fresh fish quantity increased from an estimated 17 million tonnes in 1992 to 26 million tonnes in 2002, representing an increase in its share in total production from 20 percent to 30 percent. Processed fish for human consumption (frozen, cured and canned) remained relatively stable at around 39 million tonnes. Freezing represents the main method of processing fish for food use, accounting for 53 percent of total processed fish for human consumption in 2002, followed by canning (27 percent) and curing (20 percent). In developed countries, the proportion of fish that is frozen has been constantly increasing, and it accounted for 42 percent of production in 2002. By comparison, the share of frozen products was 13 percent of total production in developing countries, where fish is largely marketed in fresh/chilled form.

Utilization of fish production shows marked continental, regional and national differences. The proportion of cured fish is higher in Africa (16 percent in 2002) and Asia (11 percent) compared with other continents. In 2002, in Europe and North America, more than two-thirds of fish used for human consumption was in frozen and

[17] M.N. Bruton. 1995. Have fishes had their chips? The dilemma of threatened fishes. *Environmental Biology of Fishes*, 43: 1–27.

[18] M. Halwart. 2003. Traditional use of aquatic biodiversity in rice-based ecosystems. *FAO Aquaculture Newsletter*, 29: 9–15.

Figure 21

Trend in utilization of world fisheries production, 1962–2002

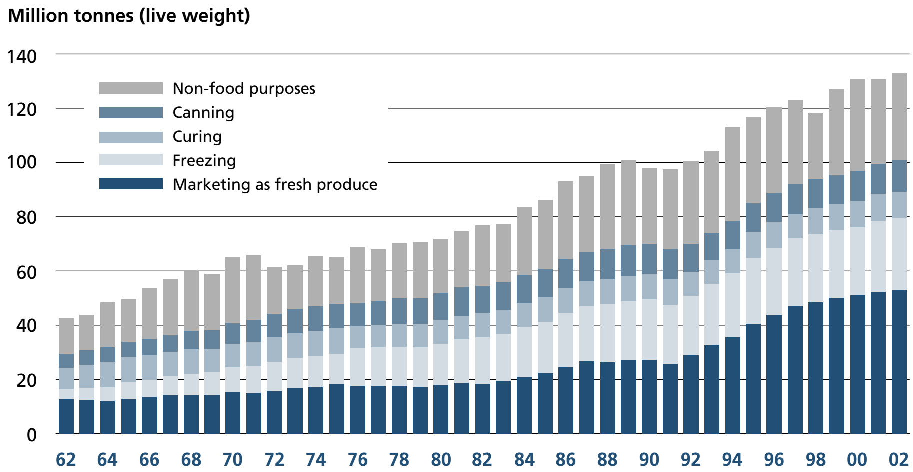
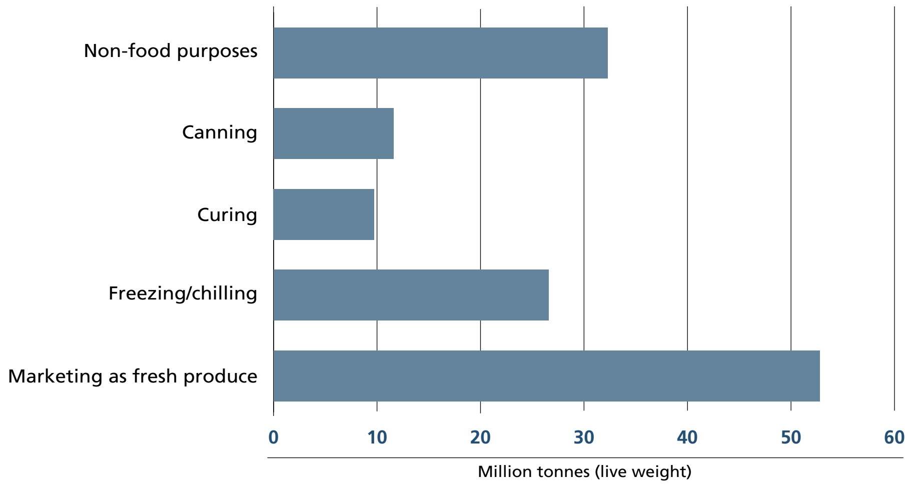


Figure 22

Utilization of world fisheries production (breakdown by quantity), 2002



canned forms. In Africa and Asia, the share of fish marketed in live or fresh forms was particularly high. Unfortunately, it is not possible to determine the exact amount of fish marketed in live form from available statistics. The sale of live fish to consumers and restaurants is especially strong in Southeast Asia and the Far East.

In 2002, almost all the fish products used for non-food purposes came from natural stocks of small pelagics, which represented 37 percent of total capture fisheries. Most of these fishery products were used as raw material for the production of animal feed and other products. Ninety percent of world fish production (excluding China) destined for non-food purposes was reduced to fishmeal/oil; the remaining 10 percent was largely utilized as direct feed in aquaculture and for fur animals. The quantity of pelagic fish used for animal feed (21 million tonnes) was slightly (3 percent) higher than that in 2001, when production was 13 percent lower than levels in 2000. But it is still well below peak levels of more than 29 million tonnes recorded in the mid-1990s.

Fish consumption

In 2002, average apparent per capita consumption of fish, crustaceans and molluscs worldwide was estimated to be about 16.2 kg, 21 percent higher than in 1992 (13.1 kg). This growth is largely attributable to China, whose estimated share of world fish production increased from 16 percent in 1992 to 33 percent in 2002. If China is excluded, the per capita fish supply would be 13.2 kg, almost the same as in 1992. Following a peak of 14.6 kg in 1987, world per capita fish supply, excluding China, showed a declining trend from the late 1980s to the early 1990s but has stabilized since then (Figure 2, p. 5). The declining trend was mainly caused by population growth outpacing that of food fish supply during the 1987–2002 period (1.3 percent per annum compared with 0.6 percent, respectively). For China, the corresponding annual increase since 1987 was 1.1 percent for population growth and 8.9 percent for food fish supply. In 2002, per capita fish supply in China was about 27.7 kg.

Fish represents a valuable source of micronutrients, minerals, essential fatty acids and proteins in the diet of many countries.[19] It is estimated that fish contributes up to 180 kilocalories per capita per day, but reaches such high levels only in a few countries where there is a lack of alternative protein foods, and where a preference for fish has been developed and maintained (for example in Iceland, Japan and some small island developing states). More commonly, fish provides about 20 to 30 kilocalories per capita per day. Fish proteins are a crucial dietary component in some densely populated countries, where the total protein intake level may be low, and are significant in the diets of many other countries. For instance, fish contributes to, or exceeds 50 percent of total animal proteins in some small island developing states and in Bangladesh, Cambodia, the Congo, the Gambia, Ghana, Equatorial Guinea, Indonesia, Japan, Sierra Leone and Sri Lanka. Overall, fish provides more than 2.6 billion people with at least 20 percent of their average per capita intake of animal protein. The share of fish proteins in total world animal protein supplies rose from 14.9 percent in 1992 to a peak of 16.0 percent in 1996, before declining slightly to 15.9 percent in 2001. Corresponding figures for the world, excluding China, show an increase from 14.3 percent to 14.7 percent in 2001 during the same period. Figure 23 presents the contributions of major food groups to total protein supplies.

In industrialized countries (Table 10), apparent fish consumption rose from 24 million tonnes (live weight equivalent) in 1992 to 26 million tonnes in 2001, with a rise in per capita consumption from 28.0 kg to 28.6 kg. The contribution of fish to total protein intake declined slightly from 8.0 percent in 1992 to 7.7 percent in 2001. In these countries, the share of fish in total protein intake rose consistently until 1989 (by between 6.5 percent and 8.5 percent), when it began a gradual decline as the consumption of other animal proteins began to increase; by 2001, its contribution was back at the levels prevailing in the mid-1980s. Since the early 1990s, consumption of fish protein has remained relatively stable at around 8.1–8.3 g per capita per day, while the intake of other animal proteins has continued to rise.

In 1992 the average per capita apparent fish supply in low-income food-deficit countries (LIFDCs) was 9.5 kg – only one-third of the estimated supply in the richest countries. The gap has been reduced progressively and by 2001 average per capita consumption (14.0 kg) had reached more than half that of the more affluent economies. However, if China is excluded, per capita supply in the other LIFDCs is still relatively low, at an estimated 8.5 kg in 2001, with a growth rate of less than 1 percent per year since 1992. Notwithstanding the relatively low fish consumption by weight in LIFDCs, the contribution of fish to total animal protein intake in 2001 was significant at more than 20 percent, and may be higher than indicated by official statistics in view of the unrecorded contribution of subsistence fisheries. However, the share of fish proteins in

[19] The term "fish" indicates fish, crustaceans, molluscs, excluding aquatic mammals and aquatic plants.

Figure 23

Total protein supply by continent and major food group (1999–2001 average)

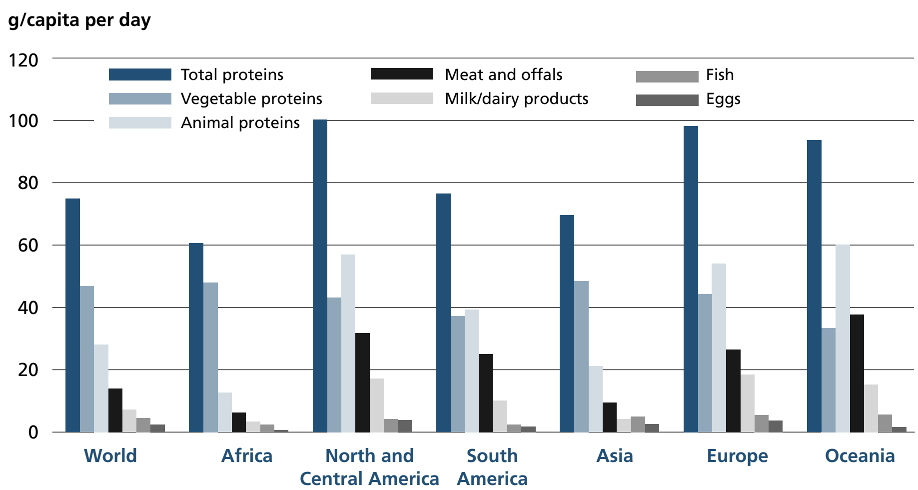


Table 10

Total and per capita food fish supply by continent and economic grouping in 2001

	Total food supply *(million tonnes live weight equivalente)*	Per capita food supply *(kg/year)*
World	**100.2**	**16.3**
World excluding China	**67.9**	**13.9**
Africa	6.3	7.8
North and Central America	8.5	17.3
South America	3.1	8.8
China	32.3	25.6
Asia (excluding China)	34.8	14.1
Europe	14.4	19.8
Oceania	0.7	23.0
Industrialized countries	26.0	28.6
Economies in transition	4.7	11.4
LIFDCs (excluding China)	22.5	8.5
Developing countries excluding LIFDCs	14.9	14.8

Note: Based on data available to FAO in December 2003. Some discrepancy may occur with other sections that quote data made available to FAO more recently.

animal proteins has continued unchanged over the past three decades as a result of the fast growth in the consumption of other animal proteins.

The role of fish in nutrition shows marked continental, regional and national differences as well as income-related variations (Figures 24 and 25). For example, worldwide, 100 million tonnes were available for consumption in 2001, but only 6.3 million tonnes were consumed in Africa (7.8 kg per capita); two-thirds of the total were consumed in Asia, of which 34.8 million tonnes were consumed outside China (14.1 kg per capita) and 32.3 million tonnes in China alone (25.6 kg per capita). Per capita consumption in Oceania was 23.0 kg, in North America 21.6 kg, in

Box 3

Mainstreaming fisheries into national development and poverty reduction strategies

The fisheries sector plays an important role in the alleviation of poverty and the achievement of food security in many parts of the world. Fisheries exports now generate more foreign exchange (either through export earnings or licence receipts) than the revenues earned from any other traded food commodity such as rice, cocoa, coffee or tea. Worldwide, more than 38 million people are directly engaged in fishing and fish farming as a full-time or, more frequently, part-time occupation, and fishery products account for 15–16 percent of global animal protein intake. Seventy percent of the fish for human consumption is presently supplied by developing countries. The fisheries sector is particularly important for 44 countries (15 small island developing states [SIDS], 12 African and 12 Asian countries, 3 transition economies and 2 Latin American countries) where the sector makes a significant contribution to both exports and domestic nutritional intake.[1] However, this contribution is generally not reflected in the national policies of these countries.

A recent study[2] showed that many national development plans [NDPs], poverty reduction strategy papers [PRSPs], World Bank Country Assistance Strategies and EU Country Strategy Papers only briefly acknowledge the fisheries sector. In general, national policy documents fail to integrate substantially the fisheries sector; nor do they recognize the causal linkages between fisheries and poverty. The sector has been most effectively mainstreamed in Asia (in the case of PRSPs and NDPs), closely followed by the African economies and the SIDS. By contrast, Latin America, which is home to two of the top six global fishing nations (Chile and Peru), scores extremely poorly in this regard.

In addition, an approach to fisheries mainstreaming that pays attention to gender roles is only apparent in a few national policy documents notwithstanding the marked demarcation of the sector in gender role terms. Moreover, despite FAO's wide-ranging efforts to promote the sustainable exploitation of aquatic living resources in harmony with the environment, through the Code of Conduct for Responsible Fisheries, just one NDP (Malaysia) makes explicit reference to the Code.

Further efforts should therefore be made to ensure the effective integration of fisheries into key national policy documents relating to poverty reduction and rural development, paying particular attention to gender issues and internationally recognized fishery development instruments such as the Code of Conduct for Responsible Fisheries.

[1] The sector was deemed to be significant in those instances where the contribution of fisheries to agricultural export trade and daily animal protein intake is greater than 10 per cent.

[2] FAO. 2004. *Mainstreaming fisheries into national development and poverty reduction strategies: current situation and opportunities*, by A. Thorpe. FAO Fisheries Circular No. 997. Rome.

Europe 19.8 kg, in Central America and the Caribbean 9.3 kg and in South America 8.7 kg.

In 2002, 60.5 percent of the world food fish supply originated from capture fisheries production; the remaining amount came from aquaculture (Figure 26). The contribution of inland and marine capture fisheries to per capita food supply declined slightly in the last decade and in particular since 1997, with a decrease of the per capita supply from almost 10.8 kg in 1997 to 9.8 kg in 2002. Worldwide, excluding China, per capita food fish supply from capture fisheries declined from 11.5 kg in 1997 to 10.8 kg in 2002. On the other hand, excluding China, the average contribution of aquaculture to per capita supply grew from 13.0 percent in 1992 to 18.4 percent in 2002, corresponding to an increase from 1.7 kg per capita in 1992 to 2.4 kg in 2002 (average annual growth of 3.5 percent). Corresponding figures for China indicate an increase from 55.5 percent in 1992 to 79.8 percent in 2002. The per capita supply from aquaculture in China is reported to have increased from 7.1 kg in 1992 to 21.8 kg in 2002, implying an annual average growth of 11.9 percent.

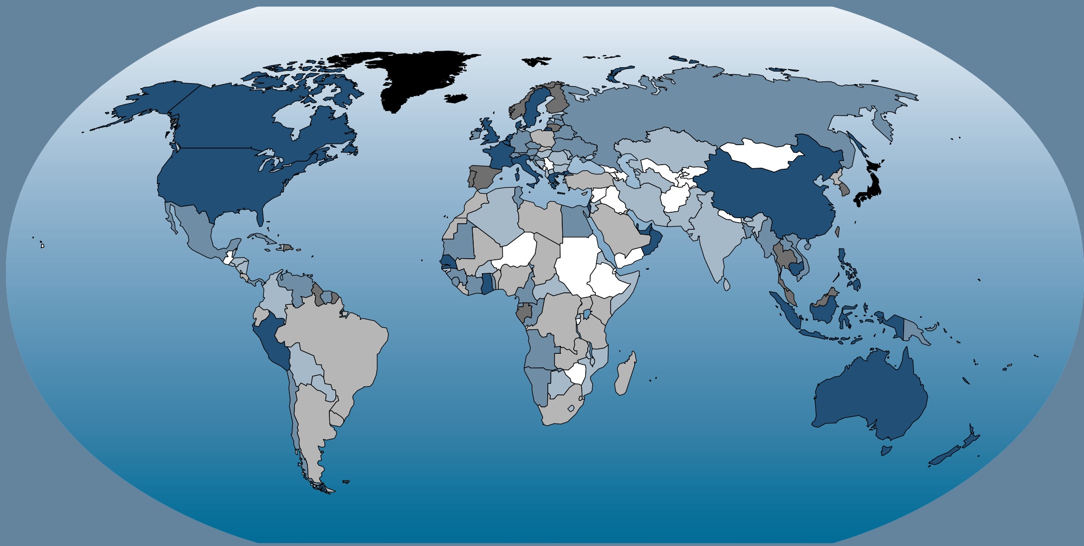
Fish consumption is distributed unevenly around the globe; there are significant differences among countries, with per capita apparent consumption ranging from less than 1 kg per capita to more than 100 kg. Geographical differences are also evident within countries, with consumption usually being higher in coastal areas. Dietary consumption patterns are influenced by complex interactions of several factors such as availability, income, prices, tradition and tastes, as well as demographic and lifestyle trends. Over the last few years, the consumption of fish and fishery products has been strongly influenced by improvements in transportation, in marketing and in food science and technology, which have led to significant improvements in efficiency, lower costs, wider choice and safer and improved products. The extent and range of these changes have varied among regions. In general, there has been a growth of fish and fishery products marketed in fresh form and in the production of ready-to-cook or ready-to-eat products, particularly in wealthy economies.

Differences in consumption patterns by species are even more marked. Demersal fish are preferred in northern Europe and North America, whereas cephalopods are consumed extensively in several Mediterranean and Asian countries, but to a much lesser extent in other regions. Despite the fast-growing contribution of aquaculture to food fish supplies and related reduction in the price of traded commodities, crustaceans are still high-priced commodities and their consumption is mostly concentrated in affluent economies. Of the 16.3 kg of fish per capita available for consumption in 2001, the vast majority (74 percent) comprised finfish. Shellfish supplied 25 percent – or about 4 kg per capita, subdivided into 1.5 kg of crustaceans, 2.0 kg of molluscs and 0.5 kg of cephalopods.

Freshwater and diadromous species accounted for 29 million tonnes of the total supply (about 4.7 kg per capita). Marine finfish species provided more than 45 million tonnes, of which almost 18 million tonnes were demersal species, 19 million tonnes pelagics and 9 million tonnes unidentified marine fish. The remaining share of the total food supply consisted of shellfish, of which 9.2 million tonnes were crustaceans, 3.3 million tonnes were cephalopods and 12.7 million tonnes were other molluscs. Historically, there have not been any dramatic changes in the share of most of the broader groups in average world consumption: demersal fish species have stabilized at around 2.9 kg per capita and pelagic fish at 3.0 kg. Crustaceans and molluscs are exceptions in that they showed a considerable increase between 1961 and 2001: the per capita availability of crustaceans increased more than three-fold, from 0.4 kg to 1.5 kg (mainly as a result of the increased production of shrimps and prawns from aquaculture), and the availability of molluscs (excluding cephalopods) increased from 0.6 kg to 2.1 kg per capita.

Figure 24

Fish as food: per capita supply (average 1999–2001)

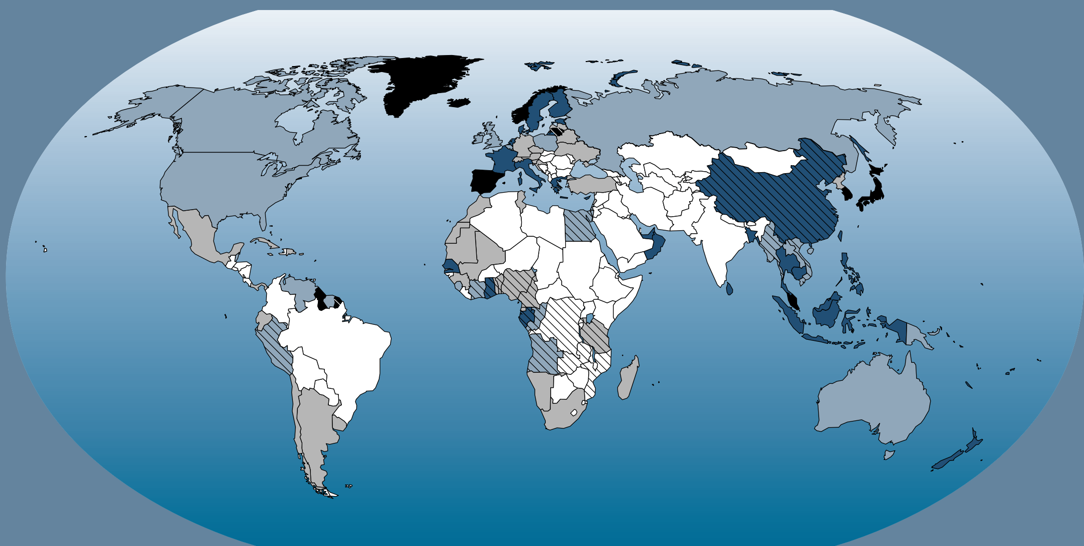


Average per capita fish supply (in live weight equivalent)

- 0–2 kg/year
- 2–5 kg/year
- 5–10 kg/year
- 10–20 kg/year
- 20–30 kg/year
- 30–60 kg/year
- > 60 kg/year

Figure 25

Contribution of fish to animal protein supply (average 1999–2001)



Fish proteins (per capita per day)

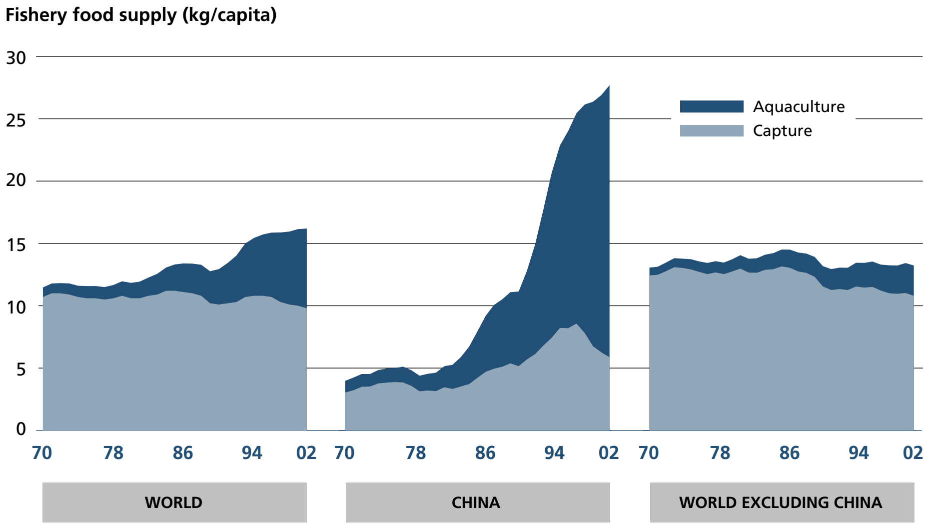
- < 2 g
- 2–4 g
- 4–6 g
- 6–10 g
- > 10 g

Contribution of fish to animal protein supply

- > 20%

Figure 26

Relative contribution of aquaculture and capture fisheries to food fish consumption



FISH TRADE

In 2002, total world trade of fish and fish products increased to US$58.2 billion (export value), representing a 5 percent increase relative to 2000 and a 45 percent increase since 1992 (Figure 27). In terms of quantity, exports were reported to be 50 million tonnes (live weight equivalent), having grown by 40.7 percent since 1992, but showing a slight decline (1.0 percent) compared with 2000 levels. The quantity of fish traded has remained stagnant over the last few years following decades of strong increases. Many of the economic factors responsible for the high growth in world fishery trade in the previous decade have now diminished in importance or are not strong enough to sustain past performance levels. While preliminary estimates for 2003 indicate a slight increase in the value of fishery exports, it is unlikely that the trends of pre-2000 years will be repeated in the short term, especially given setbacks resulting from geopolitical tensions.

In 2002, China overtook Thailand for the first time to become the world's main exporter of fish and fish products, with exports valued at an estimated US$4.5 billion. Notwithstanding this achievement, China's fishery exports represented only 1.4 percent of its total merchandise exports and 25 percent of its agricultural exports (excluding forestry products). China has experienced remarkable increases in its fishery exports since the early 1990s (average growth of 11 percent per year in the period 1992–2002) and in particular since 1999 (average growth of 24 percent in 1999–2002). These increases are linked to growing production, as well as to the development of China's fish-processing industry. The latter offers competitive labour and production costs. In addition to exports from domestic fisheries production, China also exports reprocessed imported raw material, creating a strong value-addition in the process. Imports of fish and fish products have increased significantly over the last decade, rising from US$0.7 billion in 1992 to US$2.2 billion in 2002, making China the world's eighth largest fish importer. The growth was particularly marked in the last few years, with a 94 percent increase in imports from 1999. With its accession to the World Trade Organization (WTO) in late 2001, China had to commit itself to lowering its import duties, which decreased from an average import tariff as high as 15.3 percent in 2001 to 11 percent in 2003 and 10.4 percent in 2004.

In 2002, Thailand, which had been the main exporter of fish and fish products since 1993, reported export values of US$3.7 billion, 9 percent lower than in 2001 and 16 percent below 2000 values. Norway was the third largest exporter with exports

Box 4

Fish contaminants

Introduction

Several organic and inorganic compounds can find their way into fish and seafood. These compounds can be divided into three major groups:

- **Inorganic chemicals:** arsenic, cadmium, lead, mercury, selenium, copper, zinc and iron.
- **Organic compounds:** polychlorinated biphenyls (PCBs), dioxins and insecticides (chlorinated hydrocarbons). This is a very diverse group with a wide range of industrial uses and a chemical stability that allows them to accumulate and persist in the environment.
- **Processing-related compounds:** sulphites (used in shrimp processing), polyphosphates, nitrosamines and residues of drugs used in aquaculture (e.g. antibiotics or hormones).

Many of the inorganic chemicals are essential for life at low concentration but become toxic at high concentration. While minerals such as copper, selenium, iron and zinc are essential micronutrients for fish and shellfish, other elements such as mercury, cadmium and lead show no known essential function in life and are toxic even at low concentrations when ingested over a long period. These elements are present in the aquatic environment as a result of natural phenomena such as marine volcanism and geological and geothermal events, but are also caused by anthropogenic pollution arising from intensive metallurgy and mining, waste disposal and incineration, and acidic rain caused by industrial pollution. This is in contrast with organic compounds, most of which are of anthropogenic origin brought to the aquatic environment by humans.

Increasing amounts of chemicals may also be found in predatory species as a result of *biomagnification*, which is the concentration of the chemicals in higher levels of the food chain. Similarly, they may be present as a result of *bioaccumulation*, when chemicals in the body tissues accumulate over the life span of the individual. In this case, a large (i.e. older) fish will have a higher content of the chemical concerned than a small (younger) fish of the same species. The presence of chemical contaminants in seafood is therefore highly dependent on geographic location, species and fish size, feeding patterns, solubility of chemicals and their persistence in the environment.

Risks from fish contaminants

But what are the risks to human health caused by these contaminants as a result of consuming fish and seafood?

Several studies indicate that in the open seas, which are still almost unaffected by pollution, fish mostly carry only the natural burden of these inorganic chemicals. However, in heavily polluted areas, in waters that have insufficient exchange with the world's oceans (e.g. the Baltic Sea and the Mediterranean Sea), in estuaries, in rivers and especially in locations that are close to industrial sites, these elements can be found at concentrations that exceed the natural load.

Likewise, several studies have concluded that levels of these chemicals in fish intended for human consumption are low and probably below levels likely to affect human health. Nevertheless, they can be of potential concern for populations for whom fish constitutes a major part of the diet and for pregnant and nursing women and young children who consume substantial quantities of oily fish. These concerns can only be clarified if updated and focused risk assessments are conducted.

While scientists and other experts recognize that certain of these elements are present naturally in fish and seafood, some consumers regard their presence even at minimal levels as a hazard to health. Consequently, food scares can be easily started and further amplified if communication is mismanaged – particularly given the growing speed of communication and information dissemination facilitated by the Internet. A number of such scares concerning fish contaminants have recently led to significant negative impacts on fish trade flows.

Example 1: Mercury in fish

In 2003, the Codex Joint Expert Committee on Food Additives (JECFA), administered by FAO and the World Health Organization (WHO), revised the guideline for mercury in fish to 1.6 micrograms of methyl mercury intake per day per kilogram of body weight, nearly half the original guideline of 3.3 micrograms.[1] At the same time, the JECFA review emphasized that people should continue to eat a normal diet of fish, pointing out its many health benefits. Included in its considerations was the recently released Seychelles Islands study, which analyzed mother and child pairs and fish consumption for almost ten years. That study determined that high levels of fish consumption led to no adverse effect to a foetus or child's neurodevelopment.

In order to translate the recommended weekly intake of mercury into national maximum mercury levels in fish it is necessary to take into account consumption patterns, other sources of mercury intake and other relevant information. However, public pressure often leads to consumer confusion between the maximal allowable levels necessary to protect human health and the limits recommended to protect the environment. The latter require that appropriate actions be taken consistently and for a significant period of time in order to reduce the environmental burden of the contaminant. In the case of mercury, for example, proper energy policies would be required to reduce reliance on coal-fired power stations and the reduction of waste incineration; these two factors combined account for 70 percent of new, human-made mercury emissions to the atmosphere.

Unfortunately, a number of media articles and public health warnings exacerbated the pre-existing consumer confusion and sent out conflicting messages regarding the health benefits of fish and seafood and the mercury risks from fish to the point that local authorities in California, the United States, instructed grocery retailers to display signs cautioning consumers about the dangers of mercury in fish and threatened to sue those that did not abide.

[1] FAO/WHO. 2003. *Summary and conclusions*. Joint Expert Committee on Food Additives, Sixty-first Meeting, Rome, 10–19 June (available at http://www.who.int/ipcs/food/jecfa/summaries/en/summary_61.pdf; accessed September 2004).

Box 4 *(cont.)*

Since then, the Food and Drug Administration (FDA) and Environmental Protection Agency (EPA) in the United States have released a consumer advisory document along the lines of the recent JECFA guidelines but stressing that fish and shellfish are an important part of a healthy diet. Despite this measure, the tuna industry considers that the damage already inflicted will be difficult to repair.

Example 2: Organic pollutants in salmon

A recent study published in the magazine *Science* reported on "Global assessment of organic contaminants in farmed salmon".[2] Concentrations of 14 chlororganic compounds in farmed and wild salmon were examined. Each of these compounds is thought to cause cancer. The study revealed that all the substances tested were present in higher concentrations in farmed salmon than wild salmon. This applied in particular to fish produced on European farms. Although the levels found were consistent with results from earlier surveys and official controls, the researchers concluded hastily that consumers should tightly limit their consumption of farmed salmon and suggested that anyone who does not want to additionally increase the risk of getting cancer should restrict consumption of one portion of farmed salmon to a maximum of once every two months.

On the basis of the identified concentrations of toxic substances, the authors of the study then calculated the portion sizes for wild and farmed salmon that could be consumed without increasing the risk of cancer. The recommended quantities fluctuate strongly depending on the salmon's origins. Whereas, for example, eight portions (227 g) of salmon from Kodiak (Alaska) could be consumed per month, consumers should not eat more than one portion of Chilean farmed salmon per month, no more than one portion of Norwegian farmed salmon every two months, or one portion of farmed salmon from Scotland or the Faeroe Islands no more than every four to five months.

It is these calculations that caused a big stir. The model used for the calculations is highly disputed among scientists and is not specifically intended for calculations on commercially produced fish; it had been developed by the EPA to estimate how much of their catches could be eaten by anglers who regularly fished in contaminated inland waters. By contrast, commercial products should be evaluated according to the FDA criteria. To refute the model, researchers calculated that on the basis of the PCB contamination levels cited in the study, after 70 years of regular consumption of 200 g of salmon per week the risk of developing cancer for the high-risk group (pregnant women, children, nursing mothers) would be one-hundred-thousandth higher – equal to a rise in risk of 0.0001 percent. By comparison, the risk of dying of a cardiovascular disease by eliminating fish completely from the diet can be as high as 30 percent![3]

[2] R.A. Hites, J.A. Foran, D.O. Carpenter, M.C. Hamilton, B.A. Knuth and S.J. Schwager. 2004. Global assessment of organic contaminants in farmed salmon. *Science*, 303(5665): 226–229.

[3] Does farmed salmon cause cancer? *Eurofish,* 2004/1: 62–65

It is therefore understandable that the recommendations made by the authors of the *Science* study to limit salmon consumption met with strong objections in Europe, the United States and elsewhere. Food control and health authorities reacted by announcing that its findings did not raise new food safety issues as the levels were consistent with results from other surveys and official controls. They encouraged consumers to continue eating salmon and other fish, the health benefits of which had been proven beyond all doubt in over 5 000 scientific studies. Unfortunately, the study had already alarmed the consuming public, and retail orders of farmed fish fell by 20–30 percent in countries such as Ireland, Norway and Scotland. A great deal of time and effort were required to restore consumer confidence.

Conclusion

Globalization and further liberalization of the world fish trade, while offering many benefits and opportunities, also present new safety and quality challenges. Fish safety regulators have been applying a host of control measures, from mandating the use of the Hazard Analysis and Critical Control Point (HACCP) system[4] to increasing testing, with varying degrees of success. Improved risk-based scientific tools must be adopted so that the fish safety standards reflect the most current and effective scientific methods available to protect public health.

In establishing maximum levels of fish pollutants, regulators need to ensure the highest level of consumer health protection, but they must also take into account the reality of the current background contamination of the environment in order not to endanger the food supply. Concurrently, strategies must be adopted to reduce gradually the background contamination of the environment and lower progressively the maximum levels in feed and foods to follow this downward trend. In addition, consumer information and awareness programmes will be necessary in order to improve transparency and consumer education.

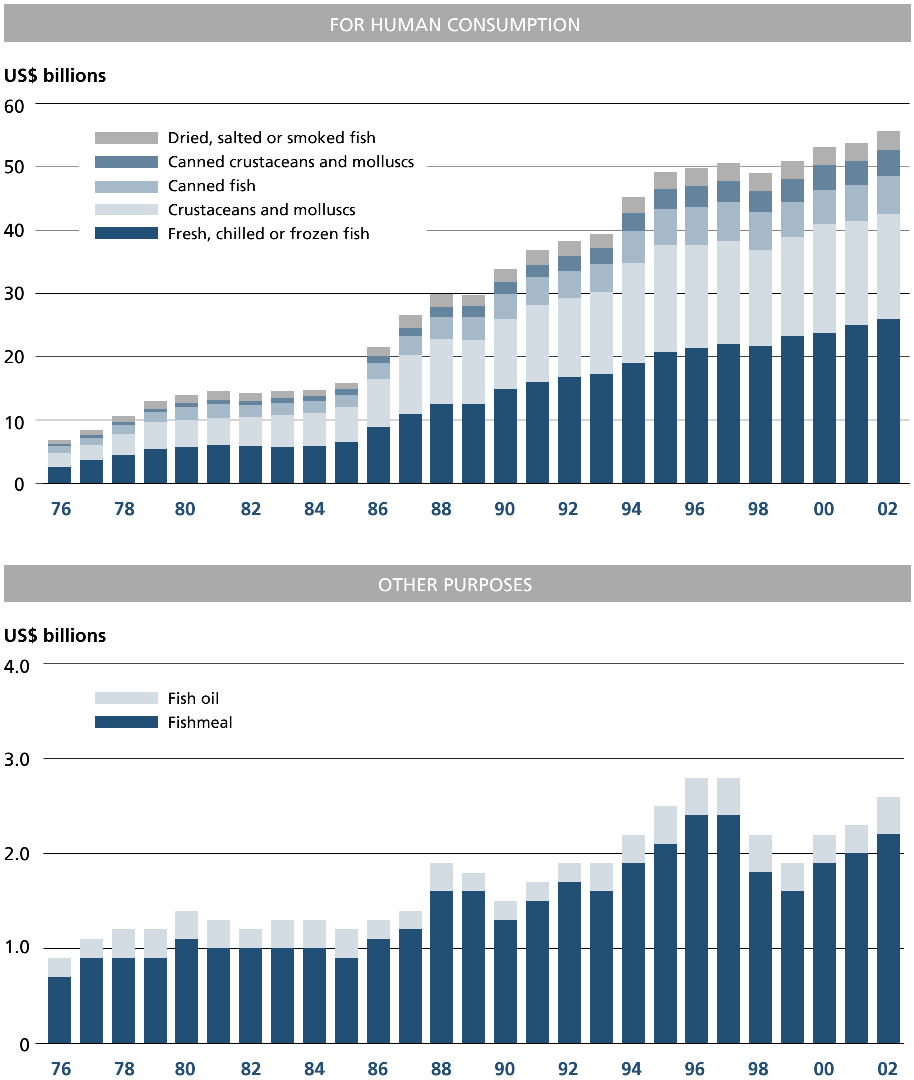
Progress in this area will require enhanced international cooperation in promoting scientific collaboration, harmonization, equivalency schemes and standard-setting mechanisms that are based on scientific principles. The World Trade Organization’s Agreements on Sanitary and Phytosanitary Measures and Technical Barriers to Trade,[5] together with the benchmarking role of the Codex Alimentarius Commission, provide an international platform in this respect. Meeting these challenges will be of the utmost importance for fish trade, both in developed and developing countries, particularly as the latter contribute more than 50 percent (in value) of international fish trade.

[4] FAO. 1997. *Hazard Analysis and Critical Control Point (HACCP) system and guidelines for its application*. Annex to CAC/RCP 1-1969. Rev. 3 (available at http://www.fao.org/DOCREP/005/Y1579E/y1579e03.htm#bm3; accessed September 2004).

[5] For further information, see http://www.wto.org/english/docs_e/legal_e/legal_e.htm#agreements; accessed September 2004.

Figure 27

World fishery exports by major commodity groups

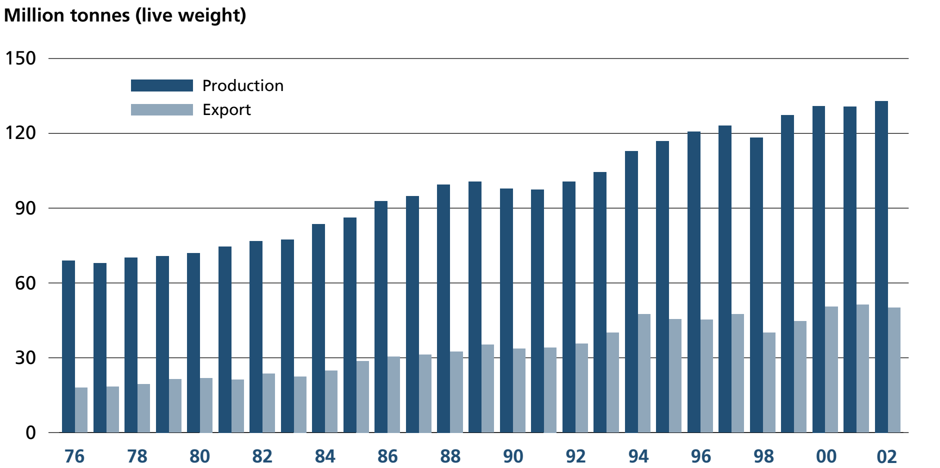


valued at US$3.6 billion, followed by the United States (US$3.3 billion), Canada (US$3.0 billion), Denmark (US$2.9 billion) and Viet Nam (US$2.0 billion). As a result of the growth in its aquaculture production, Viet Nam has significantly increased its exports of fish and fish products in the last decade (from US$0.3 billion in 1992 to US$2.0 billion in 2002), with a more accelerated growth (29 percent per year) since 1999. In 2002, the main target markets for Vietnamese exports were China, Japan and the United States. Forty-eight percent of the country's exports consisted of shrimps (mainly in frozen form).

World fish imports reached a new record of more than US$61 billion in 2002. Developed countries accounted for about 82 percent of the total value of imports of fish products. Despite the 12 percent decrease in imports from 2000 levels, Japan was once again the largest importer of fish and fish products, with a 22 percent share of the world import value in 2002. Japanese fishery imports (US$13.6 billion) accounted for 4 percent of its total merchandise trade. The United States, besides being the world's fourth largest exporting country, was the second largest importer, with imports remaining relatively stable at US$10 billion since 2000. In 2002, the EU further increased its dependency on imports for its fish supply by 10 percent since 2000. Spain, with

Figure 28

Share of world fisheries production destined for exports



US$3.9 billion, was the world's third largest importer of fish and fish products, followed by France (US$3.2 billion), Italy (US$2.9 billion), Germany (US$2.4 billion) and the United Kingdom (US$2.3 billion). Preliminary data suggest that in 2003 major importing markets increased their imports of fish and fish products by about 10 percent.

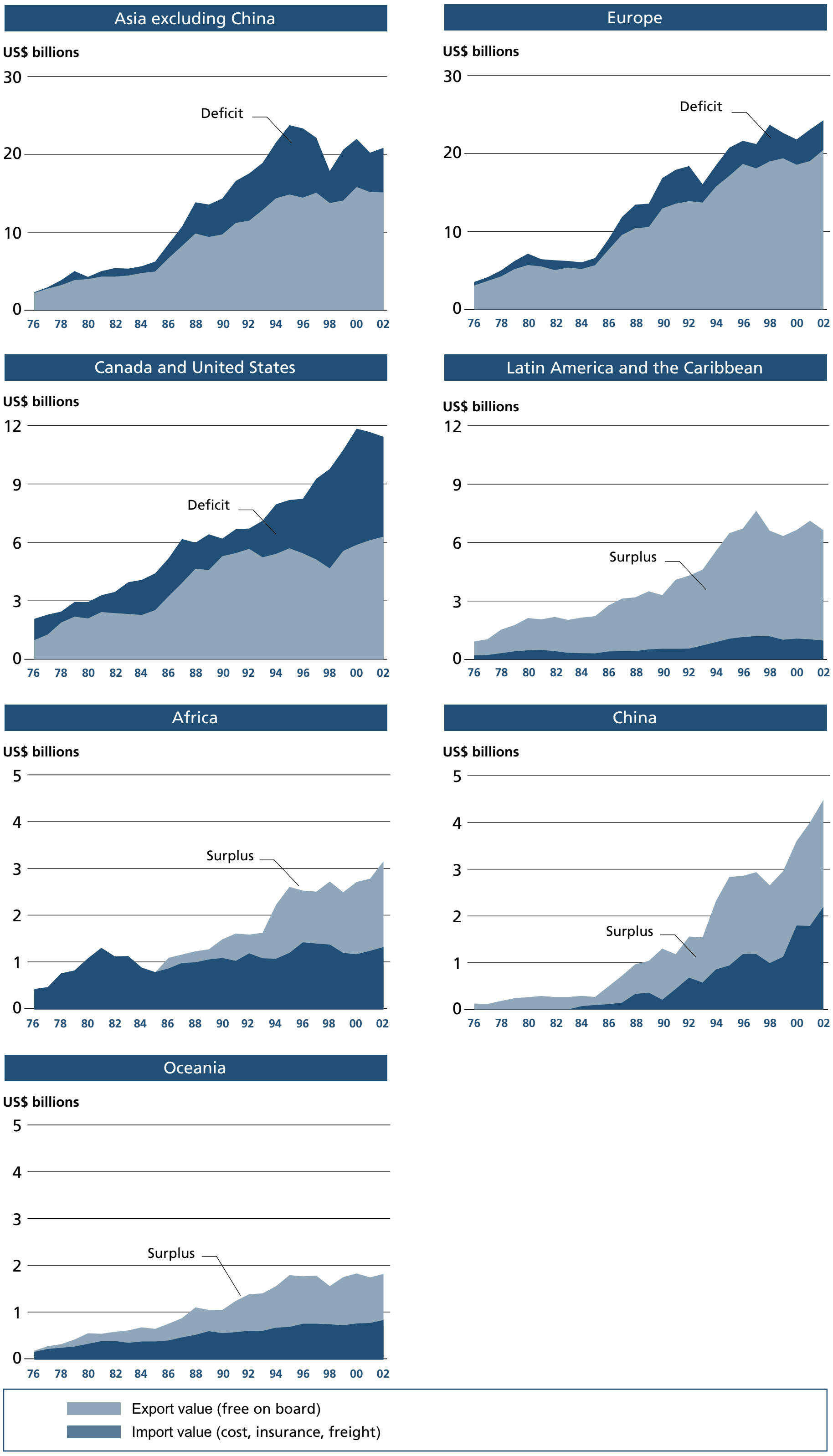
In 2002, a large share of fish production entered international marketing channels, with about 38 percent (live weight equivalent) exported as various food and feed products (Figure 28). Developed countries exported more than 22 million tonnes of fish (in live weight equivalent) in 2002; although a part of this trade may be re-exports, this amount corresponds to nearly 70 percent of their production. Exports from developing countries (28 million tonnes) were around one-quarter of their combined production. The share of developing countries in total fishery exports was 49 percent by value and 55 percent by quantity. A significant share of these exports consisted of fishmeal. In 2002, developing countries contributed about 66 percent, by quantity, of world non-food fishery exports. Developing countries have also significantly increased their share in the quantity of fish exports destined for human consumption, from 43 percent in 1992 to 49 percent in 2002.

In many countries there is considerable two-way trade in fish products. The trade surplus is significant in Africa, China, Oceania and Latin America and the Caribbean (Figure 29). In 2002, 95 countries were net exporters of fish and fishery products, with Canada, Chile, Norway, Thailand and Viet Nam reporting net export values of more than US$1.5 billion each and with Denmark, Iceland, India, Indonesia, Peru and Taiwan Province of China each having net exports worth more than US$1 billion. Although there is a strong trade in fish and fish products among the more developed economies (mostly demersal species, herring, mackerel and salmon), trade tends to flow from the less-developed to the more-developed countries (mainly tuna, small pelagics, shrimps and prawns, rock lobsters and cephalopods). In 2002, about 74 percent of the import value was concentrated in three main areas: the EU, Japan and the United States. In terms of quantity, developed countries imported over 32 million tonnes (live weight equivalent), of which 68 percent was fish for human consumption, while developing countries imported 19 million tonnes (live weight equivalent), of which 47 percent consisted of fish for food.

The maps shown in Figure 30 indicate trade flows of fish and fish products by continent for the period 2000–02. The overall picture presented by these maps, however, is not complete. Although the countries that reported their imports over this period (some 158 countries) account for 98 percent of the estimated world total, some continental groups are not covered completely (e.g. about one-third of African

Figure 29

Imports and exports of fish and fishery products for different regions, indicating net deficit or surplus



countries did not report their trade in fish products by country of origin/destination). In this case, the data indicated should not be taken to represent the total trade flow of the continental groups to which they refer.

Because fish is highly perishable, more than 90 percent of internationally traded fish and fish products are in processed form. In terms of quantity, the share of live, fresh or chilled fish has increased during the last decade from 9 percent in 1992 to 10 percent in 2002. This growth is a result of improved logistics and technology and increased demand. Live fish is particularly appreciated in Asia and in niche markets in other countries, mainly among immigrant Asian communities. In these countries, aquariums and tanks displaying live fish have become relatively common in seafood restaurants, supermarkets and retail outlets. Trade in live fish has increased in recent years due to technological developments. An elaborate network of handling, transport, distribution, display and holding facilities has been developed to support the live fish trade. New technological systems include especially designed or modified tanks and containers, as well as trucks and other transport vehicles equipped with aeration or oxygenation facilities to keep fish alive during transportation or holding/display.

Exports of frozen fish have increased during the last decade, rising from a share of 28 percent of the total quantity of fish exports in 1992 to 35 percent in 2002. Exports of prepared and preserved fish were 6.2 million tonnes (live weight equivalent) in 2002, representing a share of 12 percent of total exports (10 percent in 1992). Exports of cured fish accounted for 5 percent of total exports in 2002, but this share had declined slightly over the preceding decade. In 2002, exports of non-food products represented 36 percent of total exports in terms of quantity, a large share of which originated from Latin American countries.

Despite a slight decline in exports, shrimp continues to be the main fish commodity traded in value terms, accounting for about 18 percent of the total value of internationally traded fish products in 2002. The other main groups of exported species were groundfish (10 percent: e.g. hake, cod, haddock and Alaska pollock), tuna (9 percent) and salmon (8 percent). In 2002, fishmeal represented around 4 percent of the value of exports and fish oil less than 1 percent. Products derived from aquaculture production accounted for an increasing share of the total international trade in fishery commodities, with an estimated 22 percent of the export quantity. It is not currently possible to quantify the exact amount of fish trade originating from aquaculture because most countries do not specify the farmed origin in their fishery trade statistics.

For many economies, and in particular for developing nations, trade in fish represents a significant source of foreign currency earnings, in addition to the sector's important role in income generation, employment and food security. In a few cases, fishery exports are crucial for the economy. For example, in 2002 they represented more than half of the total value of exported commodities in the Faeroe Islands, the Federal States of Micronesia, Greenland, Iceland, the Maldives and Saint Pierre and Miquelon. The net receipts of foreign exchange derived from fish in developing countries (i.e. the total value of their exports less the total value of their imports) increased from US$11.6 billion in 1992 to US$17.4 billion in 2002 (Figure 31), despite the 3 percent decline in net receipts since 2000 – these figures were significantly higher than those for other agricultural commodities such as rice, coffee and tea. LIFDCs play an active part in the trade of fish and fish products; in 2002, they accounted for more than 20 percent of the total value of fishery exports, with net export revenues estimated at US$8.2 billion.

Trade in developing countries is gradually evolving from the export of raw material for the processing industry in developed countries to high-value live fish or value-added products. Some countries are also importing raw material for further processing and re-export. Many developed countries have invested in processing facilities in developing countries, where costs are lower. Also, numerous projects have been assisting fish-processing companies in several developing countries to produce more sophisticated products through further processing in order to increase the companies' profitability and the contribution of the fisheries sector to the gross national product. The results

Figure 30

Trade flows by continent (total imports in US$ millions, c.i.f.; averages for 2000–02)

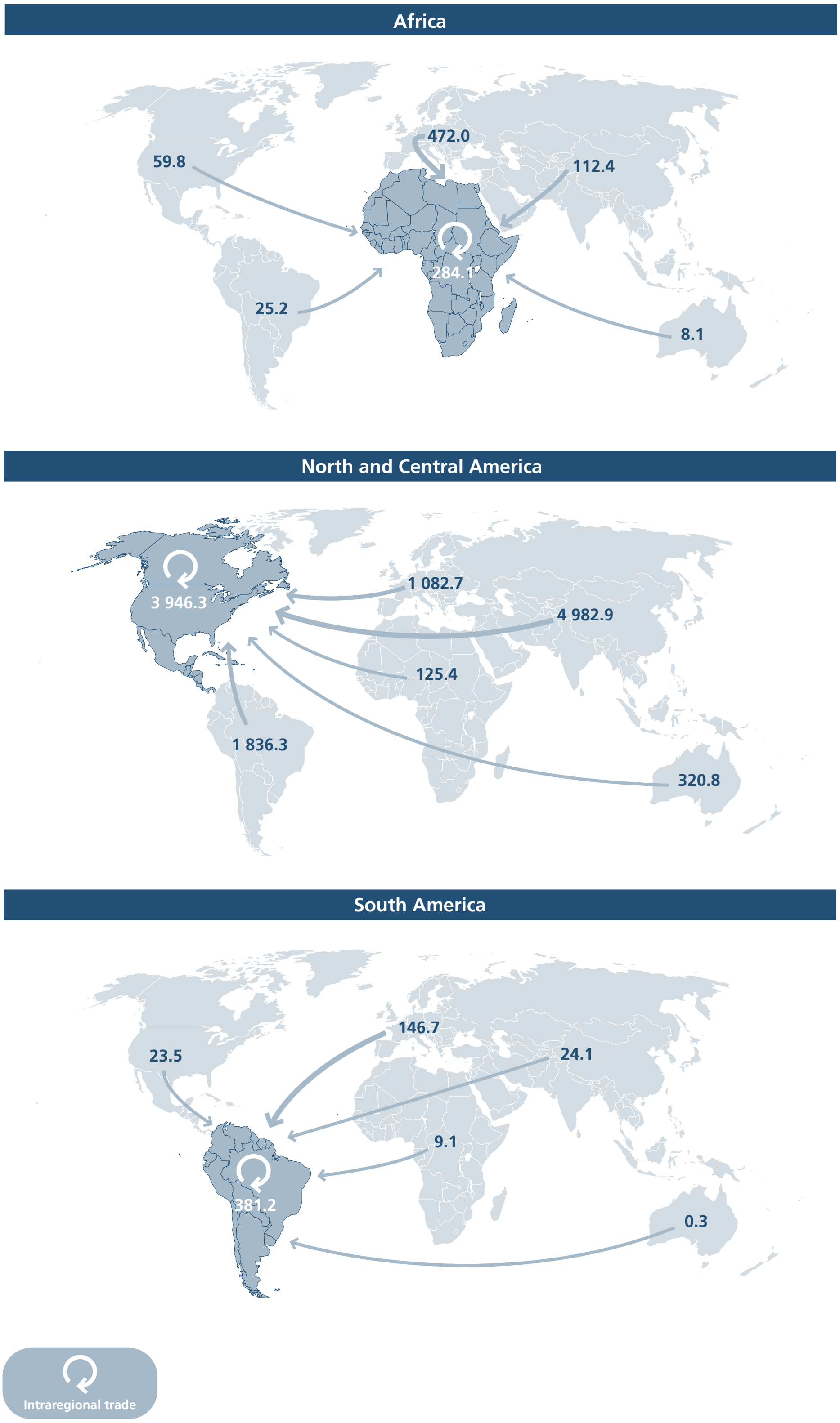


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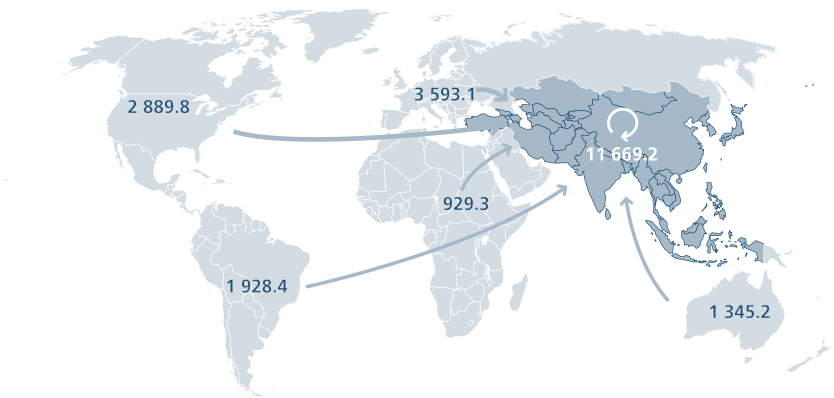
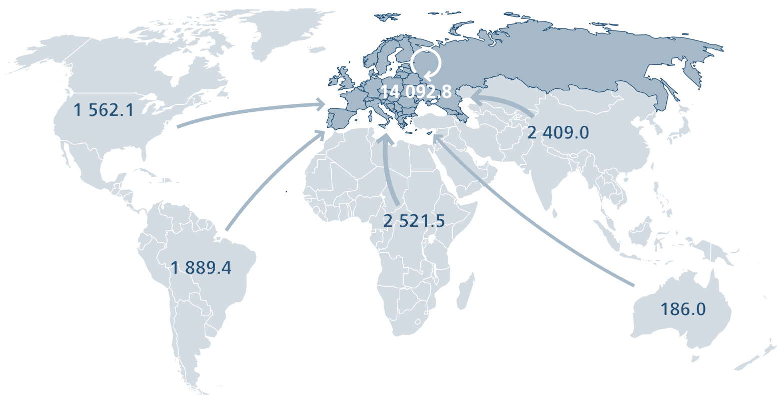
Figure 30 *(cont.)*

Trade flows by continent (total imports in US$ millions, c.i.f.; averages for 2000–02)

Asia



Europe



Oceania

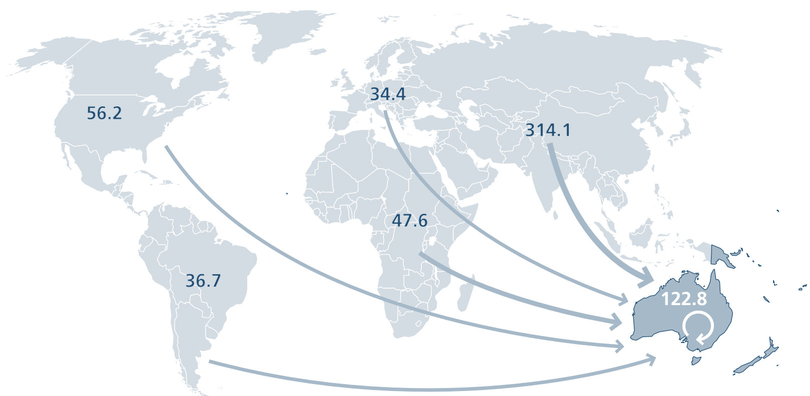
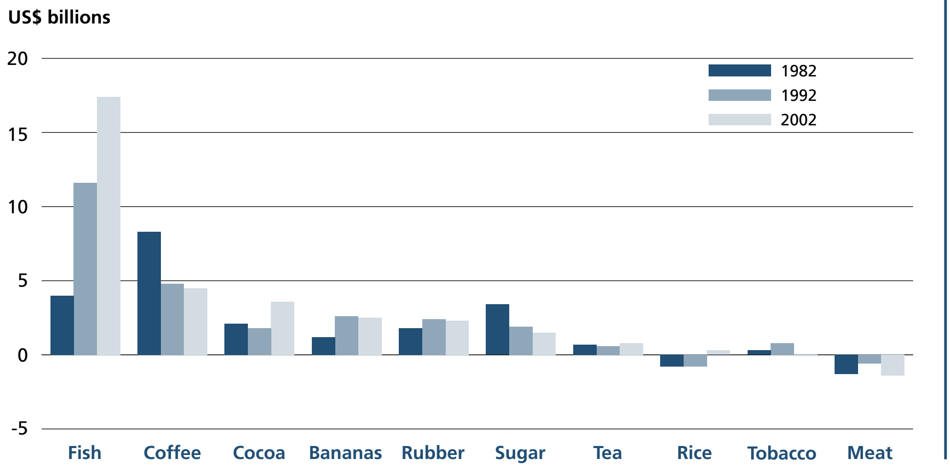


Figure 31

Net exports of selected agricultural commodities in developing countries



of these projects have often been unsatisfactory, largely because of inadequate importer–customer relationships, little or no advantage in terms of quality and price, and the failure of products to meet the needs of consumers – shortcomings resulting from inadequate market research. Experience has shown that the key to success lies in strong customer partnerships, sound market research, excellent quality of the product, reliability in supply, a constant drive for improvement, price competitiveness and attractive packaging.

In addition to value-addition and third-country processing in developing countries, other major issues concerning international trade in fish products that have been prominent in recent years include changes in quality and safety control measures in the main importing countries; the introduction of new labelling requirements and the concept of traceability in major markets in developed countries; chemical residues in aquaculture products; the general public's concern about overexploitation of certain fish stocks, especially groundfish; the sustainable development of aquaculture, including its future feed requirements; IUU fishing; international trade negotiations in the WTO; the expansion of regional trade areas and the increasing number of new bilateral trade agreements. With the entry of China into the WTO in 2001, all major fishery countries other than the Russian Federation and Viet Nam (which have started negotiations to become members) are now members of the organization. Parallel to the increase in the WTO's membership, a number of bilateral trade agreements with strong relevance to fish trade have been signed. The full impact and long-term effects of these agreements, in addition to or as a substitute for broader multilateral agreements, remain to be seen.

Salmon

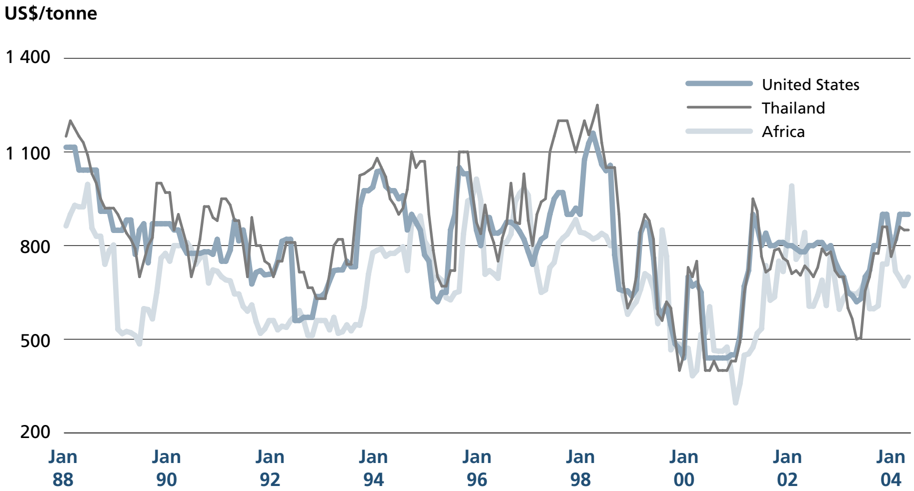
2003 was a positive year for salmon producers and traders worldwide. Increased prices particularly benefited European producers in Ireland and the United Kingdom. Chile and Norway enjoy a comparatively lower cost structure and can operate profitably at lower price levels. They were therefore profitable in earlier years when the European industry generally was experiencing heavy losses. Chile, however, was to some extent hurt by a weaker dollar in the United States, which is the major market for its fresh products.

Tuna

Japan is the top world market for *sashimi*-grade tuna. However, as in the case of shrimp, demand has declined in recent years or shifted to lower-priced species.

Figure 32

Skipjack tuna prices in Africa, Thailand and the United States



Notes: Data refer to c&f (cost and freight) prices for 4.5–7.0 pounds of fish. For Africa: ex-vessel Abidjan, Côte d'Ivoire.

The farming of bluefin tuna has had an important impact on the *sashimi* market in Japan, resulting in an overall decline of prices. The reduction of the EU canned tuna import tariff (from 24 percent to 12 percent) for a quantity of 25 000 tonnes from countries such as Indonesia, the Philippines and Thailand, was not welcomed by the main European tuna canners. On the other hand, Spanish canners are outsourcing and new canning plants have been installed by Spanish companies in Central America (El Salvador and Guatemala). The concentration of the world tuna industry in fewer hands is continuing. Canned tuna consumption is rising in European countries, which now represent the main outlet for canned tuna. By contrast, the United States market for canned tuna is declining, while that for pouch (as opposed to rigid plastic) packs is increasing. Prices of skipjack tuna in Africa, Thailand and the United States are shown in Figure 32.

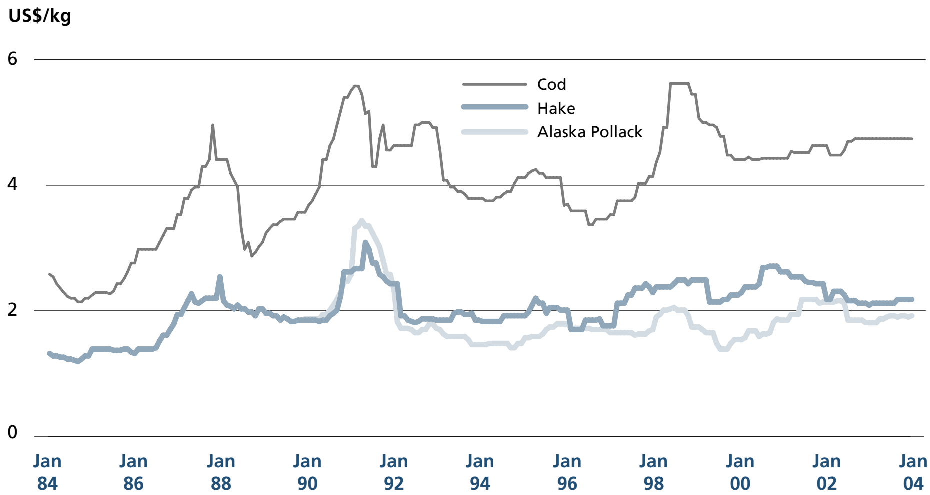
Other finfish

Relatively strong supplies of certain groundfish species (Alaska pollock and Argentinian hake) combined with resumed exports from China to EU markets and flat consumer demand had the effect of exerting downward pressure on frozen groundfish prices during 2003. Groundfish prices in the United States are shown in Figure 33. With somewhat reduced Alaska pollock supplies as well as strong Russian and Chinese demand during the first half of 2004, this negative trend came to an end and prices for certain groundfish products started to increase during the first quarter of the year. A continued scarcity of Alaska pollock during the second half of 2004 is likely to mean a general upward movement of groundfish prices in international markets despite flat demand in many key markets.

Continuous low prices, unsolved problems related to antibiotics and dumping allegations were all detrimental to groundfish exports from Asia. The *basa* (catfish) industry in Viet Nam was hit particularly hard: Vietnamese exports to the United States fell by 50 percent as a result of anti-dumping duties ranging between 37 and 64 percent that have been in force since June 2003. Consequently, *basa* fish swamped the Southeast Asian and Australian markets, creating difficulties in the markets for other freshwater fish.

Figure 33

Groundfish prices in the United States



Note: Data refer to c&f prices for blocks.

Shrimp

During 2003, shrimp imports in several key markets reached new highs. Sales to the world's largest shrimp market, the United States, exceeded 500 000 tonnes for the first time – 17 percent higher than imports in 2002. Annual imports of shrimp into Japan during 2003 declined by 6 percent compared with the previous year, continuing a long-term downward trend that is a consequence of the country's continued difficult economic situation. In Europe, shrimp imports increased in 2003, as a result of a strong euro and competitive international prices. Brazil, China, Ecuador, India, Thailand and Viet Nam are under investigation for dumping in the United States, which will create some problems for their sales there in the short term. Prices remained low during most of 2003, and there are no indications of an increase in 2004. Shrimp prices in the United States and Japan are presented in Figure 34.

Cephalopods

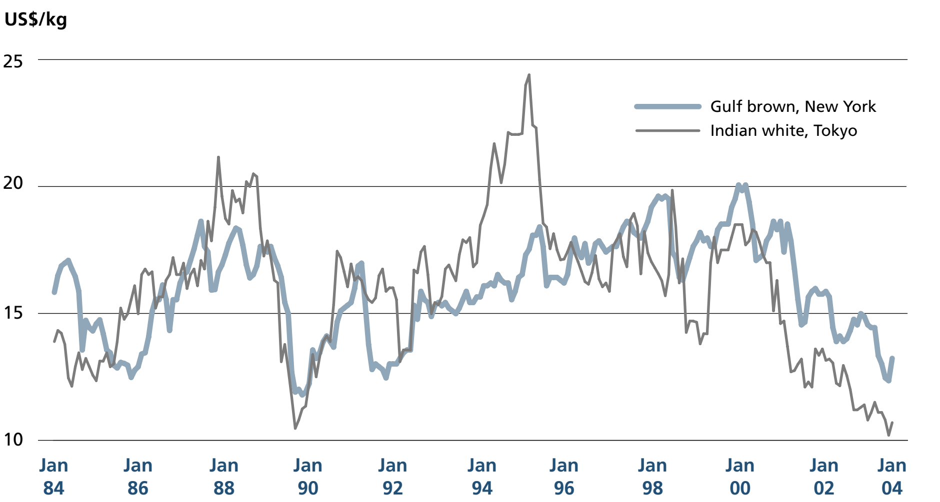
On the cephalopod market, lower *Illex* catches were offset by higher production of *Loligo* squid. Octopus catches were relatively low. The beginning of 2004 was marked by reduced squid landings, notably in the Southwest Atlantic. Spain remains the leading European squid market. During 2003, frozen imports (*Illex* and *Loligo*) increased by 7 percent over 2002 levels to almost 160 000 tonnes. This increase was the result of a 22 percent jump in *Loligo* imports that more than compensated for the 6 percent drop in frozen *Illex* imports. In 2003, the Italian squid market followed a similar trend to that of Spain, with a rise in frozen imports and a shift from *Illex* towards *Loligo*. Total imports into Italy reached 85 000 tonnes, 8 percent higher than in 2002. Japan continued to be the main market for cephalopods worldwide in 2003, but its imports were hit by low arrivals of octopus from Morocco. Imports by Japan in 2003 were 56 000 tonnes, down from 72 000 tonnes in 2002. The octopus resource in the Central East Atlantic is under stress, and no improvement to the supply situation is likely in the short term. Prices for all cephalopod products increased in 2004. Figure 35 presents cephalod prices in Japan.

Fishmeal

The bulk of fishmeal production – about 60 percent – is exported each year. In 2003, fishmeal production in the five major exporting countries amounted to 4.5 million

Figure 34

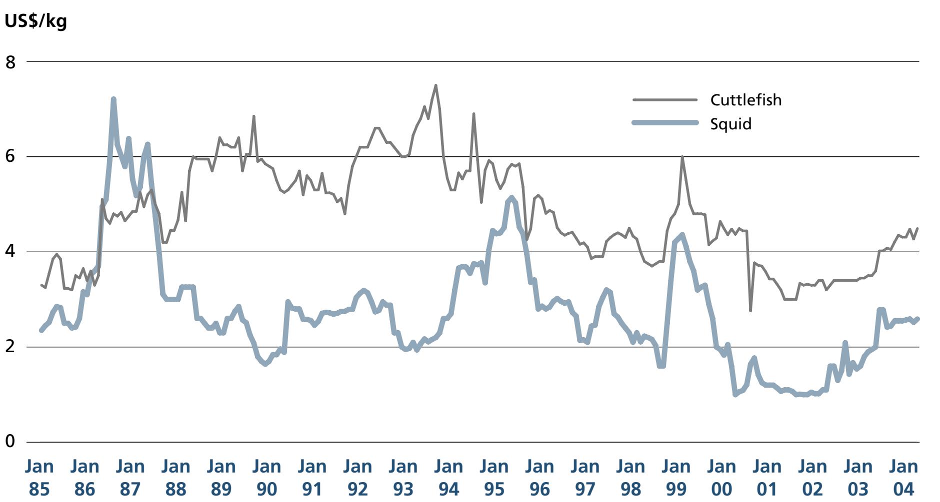
Shrimp prices in Japan and the United States



Note: Data refer to wholesale prices for frozen, headless, shell-on shrimps, 16–20 count.

Figure 35

Cephalopod prices in Japan

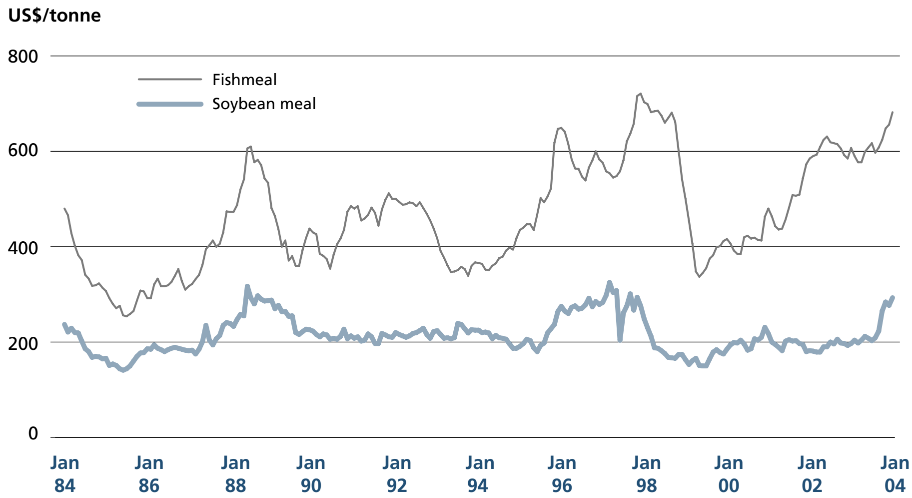


Note: Data refer to wholesale prices.
For cuttlefish: whole, 10 kg/block, 0.4–0.6 kg/pc;
for squid: whole 7.5 kg/block, 21-25 kg/pc.

tonnes, representing a 12 percent decrease from 2002. Catches of fish for reduction were low in all major fishmeal-producing countries. However, in the first six months of 2004, fishmeal production increased by 40 percent and it is likely that total production will return to normal levels. Fishmeal prices, which increased strongly in 2003, are expected to decline somewhat, but good demand, especially from China and other Asian countries, will keep them at attractive levels for the producing countries. Prices for Germany and the Netherlands are given in Figure 36.

Figure 36

Fishmeal and soybean meal prices in Germany and the Netherlands



Note: Data refer to c.i.f. prices.
Fishmeal: all origins, 64–65 percent, Hamburg, Germany
Soybean meal: 44 percent, Rotterdam, the Netherlands.

Source: OIL WORLD; FAO GLOBEFISH

THE CHANGING ROLE OF REGIONAL FISHERY BODIES IN DECISION-MAKING

Situation prior to UNCED

A clear shift in the role of regional fishery bodies (RFBs) has occurred over the past half-century – a trend that has intensified since the adoption of key international fisheries instruments following the 1992 United Nations Conference on Environment and Development (UNCED). Prior to the early 1980s, the mandates of many RFBs identified their role as research and advisory rather than decision-making and enforcement. The focus of decision-making in most RFBs was how best to serve as a forum for fisheries management rather than as a fisheries management body.

The 1982 United Nations Convention on the Law of the Sea prompted a sharp focus on the emerging role of RFBs.[20] A suite of new activities was envisaged by the Convention giving RFBs a greater role than had been intended previously. They would maintain their essential functions as fora for international cooperation; as vehicles for research, analysis and data repository and exchange; and as advisors on fisheries management in accordance with their mandates. In addition, however, the Convention foresaw new activities, such as:

- protecting stocks associated with harvested stocks from depletion;
- conserving stocks outside the 200-mile zone;
- providing advice to coastal states on the conservation of stocks inside the 200-mile zone;
- pursuing compulsory dispute settlement options;
- providing coastal states with all relevant information regarding fishing activities in high seas areas adjacent to their exclusive economic zones;
- the implementation by coastal states of appropriate minimum standards;

[20] The United Nations Convention on the Law of the Sea of was adopted and opened for signature on 10 December 1982. For more information, see http://www.un.org/Depts/los/convention_agreements/convention_overview_convention.htm.

- providing a conduit through which coastal states could fulfil their obligation to give due notice of their relevant conservation and management laws and regulations and make information available on the outer limits of their exclusive economic zones;
- considering stricter regulations for marine mammals than those required for other species.

In response to these changes, many RFBs have reviewed or amended their respective agreements or conventions. However, the 1982 UN Convention, itself, can be considered inadequate as a mechanism for promoting effective fisheries management, in view of three interrelated factors:

- The Convention does not confer management authority on RFBs.
- The Convention ushered in an era of newly declared sovereign rights over extended areas of ocean space, which became a paramount consideration for many coastal states.
- The general state of the world fisheries resources at the time did not appear to be particularly worrisome. As a result, many RFBs remained virtually inactive with respect to effective fisheries management.

Post-UNCED

In the 1990s, fuelled by growing awareness of the scarcity of fishery resources, the absence of broad international agreement on the management authority of RFBs began to receive increasing attention. The need for strengthened fisheries governance through RFBs became a pressing issue and it was acknowledged that, to be effective, RFBs needed clear mandates to manage the fishery resources in their convention areas in full conformity with international law. In this connection, a number of post-UNCED fisheries instruments were adopted by the international community; these included the 1995 UN Fish Stocks Agreement, the 1993 FAO Compliance Agreement, and the 1995 FAO Code of Conduct for Responsible Fisheries.

The strengthened conservation and management roles of RFBs, foreshadowed by the post-UNCED instruments and accompanying public demands for accountability and transparency, brought with them the need for an effective decision-making process and authority. An FAO High-Level Panel of Experts in Fisheries concluded in a 1998 report that "... the last thirty years were essential to collect information and gain experience on the functioning of RFBs and that the next ten years would be to implement and enforce decisions so that world fisheries resources could be exploited and utilized in a responsible manner".[21] A few months later, in February 1999, FAO and non-FAO regional fishery bodies, at the first ever meeting of its kind to be convened, stressed that "regional fishery bodies must measure their success by results in the form of favourable trends in or status of stocks and human benefits".[22]

Generally, it has been observed that RFBs are taking innovative and cooperative action to implement the post-UNCED international fisheries instruments, many in an effort to rebuild the depleted stocks, prevent further decline and to combat IUU fishing. In addition, the stature of RFBs in fisheries governance is growing steadily, as is reflected in the expanding obligations on states to cooperate through RFBs, the number of new RFBs established in recent years and the institutional and constitutional reforms achieved by many RFBs in order to meet current and future needs. RFBs have made important contributions to fisheries governance, *inter alia*, in the following areas:

[21] FAO. 1998. *Report of the High-Level Panel of External Experts in Fisheries. Rome, 26–27 January* (available at http://www.fao.org/docrep/meeting/w9887e.htm; accessed September 2004).

[22] FAO. 1999. *Report of the Meeting of FAO and Non-FAO Regional Fishery Bodies or Arrangements. Rome, 11–12 February.* FAO Fisheries Report No. 597. Rome.

- promoting the development of national research and management capacity;
- improving and strengthening data collection, handling and dissemination;
- addressing new issues such as IUU fishing, the management of fleet capacity, the effect of the payment of subsidies and the reduction of bycatch and discards;
- adopting management measures and resolutions relating to such issues as fishing effort reduction, the use of gear, minimum fish sizes, mesh restrictions;
- adopting rules and procedures for boarding, inspection and enforcement;
- taking measures to enable the implementation of recent international instruments.

Regrettably, assessments show that strengthened governance of RFBs does not always translate into more effective fisheries management. One of the main constraints faced by RFBs is a lack of willingness on the part of member countries to delegate sufficient decision-making power and responsibilities to RFBs, combined, in some cases, with an inability or reluctance to implement decisions taken by them.

Increased emphasis on decision-making

Article 10 of the UN Fish Stocks Agreement includes the obligation for states to "agree on decision-making procedures which facilitate the adoption of conservation and management measures in a timely and effective manner".[23] In this context, decision-making procedures are not confined to a voting formula but could involve considerations of a variety of elements. These might include, for principal bodies, clear and timely procedures for a number of actions, the entry into force of recommendations and decisions within an appropriate time period and the inclusion of an objection procedure that is consistent with the criteria of timeliness and effectiveness; for the subsidiary bodies, they might also include timely procedures for making recommendations and giving advice.

Several RFBs have taken concrete action on a wide range of decision-making objectives, functions and processes (the IATTC, for example, see Box 5). Specific areas include:

- the adoption of criteria that determine the nature or extent of participatory rights for new members, that facilitate the adoption of conservation and management measures and may encourage objectivity;
- the adoption of clear decision-making procedures both for the parent body, usually included in the constitutive instrument, and for the subsidiary bodies, generally detailed in the rules of procedure, to ensure that the recommendations or advice will be timely and effective;
- the institution of an objection procedure, the length of time and specific procedure for which varies among RFBs;
- placing greater emphasis on transparency by adopting, *inter alia*, procedures for observers that may specify qualifications, application procedure and attendance at meetings;
- focusing on related areas of dispute settlement, particularly the prevention of disputes.

However, it is important to note that, in the absence of agreed performance indicators for self-evaluation, which could conceivably include the evaluation of decision-making authority and process, it is difficult to establish a correlation between strengthening governance in terms of decision-making and effective fisheries management. This issue is further complicated by the fact that decision-making is only one of many interrelated elements of governance by RFBs.[24] The three

[23] Op. cit., footnote 3, p. 35.

[24] Others include institutional arrangements, mandate and functions, membership, members' data provision, budget and finance, capacity, enforcement mechanisms, non-parties undermining measures, cooperative management, partnership/stakeholder participation, collaboration with other RFBs, political will to implement decisions, acceptance of international instruments and dispute settlement mechanisms.

main elements in decision-making are political will, legal obligations and institutional mechanisms.

That greater demands in terms of decision-making are being placed on RFBs as they move towards becoming bodies with fishery management functions is evidenced by the requirements of post-UNCED international fisheries instruments. While RFBs have not, on the whole, actively reviewed this area of governance, the current decade, which represents a period of consolidation following the adoption of the post-UNCED instruments, could provide a platform for further elaboration of RFB decision-making procedures.

AQUACULTURE DEVELOPMENT POLICY AND GOVERNANCE

Sustainable development

Market forces are exerting a strong influence on aquaculture development, particularly that of commercial and industrial aquaculture. Middle-class consumers in many developed and developing countries are becoming increasingly influential and concerned about what they eat and at what cost food is produced, especially in the case of internationally traded products. Major importing regions and countries have begun to set stringent standards and regulations to ensure quality and safety and to reduce the social and environmental impacts of production. Aspects covered by these standards include trade in endangered species, labelling for origin, traceability, the chain of custody and zero tolerance for certain veterinary drug residues. In 2002, fish and fishery products represented the largest category (over 25 percent) of food safety and quality alerts in the EU. Aquaculture products were particularly targeted for veterinary drug residues and monitoring resulted in the banning of imports from several countries. Also, considerable progress has been made in the development and adoption of a range of market strategies – such as product certification, ecolabelling, ethical or fair trade and organic produce – aimed at improving the sector's public image and gaining consumer confidence.

Progress has also been made in addressing sustainability problems through improved technology – and further progress is expected in the future. For example, improved management practices have successfully limited the spread of pathogens from cultured to wild stocks and made it possible to reduce the use of veterinary drugs in aquaculture production. Nevertheless, there is still a need to regulate access to veterinary drugs in many developing countries. There have also been some advances in establishing effluent standards, improving feed and feeding efficiency and reducing the nutrient output of farms. Research to reduce the dependency on fishmeal in aquafeeds has been ongoing since the 1970s and the results are now being tested with varying degrees of success. Long-term solutions, such as genetic engineering to propagate plants with more suitable profiles of amino acids and fatty acids, are also being considered.

Aquaculture appears to be expanding into offshore marine areas in some parts of the world. Several countries have been proactive in developing appropriate offshore aquaculture and ocean policies, including the control of off-site impacts associated with the discharge of effluent and solid wastes and escapees, even prior to embarking on large-scale development. Pilot projects have also been initiated to gather information to guide policy and development. Operating farms in a more socially and environmentally responsible manner and making a tangible contribution to rural development and poverty alleviation in coastal areas are important challenges for the future, especially in developing countries. Many large-scale industrial production systems are becoming more sustainable, while small-scale practices and integrated systems are continuously adapting to the changing perceptions and demand.

The shift to sustainable practices and development strategies remains a work in progress and a common objective. It requires the concerted support of the public sector through the provision of an enabling environment to attract investment in responsible development and encourage innovation. Inadequate resources, the relatively low importance accorded to aquaculture compared with other priority areas in national

Box 5

The 2003 Antigua Convention and the strengthening of the Inter-American Tropical Tuna Commission

On 27 June 2003, at its 70th meeting, held in Antigua (Guatemala), the IATTC adopted the Convention for the Strengthening of the Inter-American Tropical Tuna Commission established by the 1949 Convention between the United States of America and the Republic of Costa Rica ("Antigua Convention"), bringing to a successful conclusion five years of negotiations.[1] These negotiations were open, from the outset, not only to the parties to the 1949 Convention[2] but also to all those that might become parties to or members of the Commission under the existing Convention or a revised one.[3] Interested intergovernmental organizations and NGOs were also welcome to participate and contribute as observers.

Based on the "Chairman's text" technique, the negotiating process was initially aimed at amending the 1949 Convention in order to bring it in harmony with the principles of international law as reflected in the 1982 UN Convention of the Law of the Sea and the provisions of other international instruments such as the 1992 Agenda 21, the 1993 FAO Compliance Agreement, the 1995 FAO Code of Conduct for Responsible Fisheries and the 1995 UN Fish Stocks Agreement.[4] However, the gap was so great between these instruments and the letter of the 1949 Convention that very little could be preserved from the original text.

The institutional continuity of the IATTC is stressed both in the title and the body of the Antigua Convention, but the new instrument has transformed the Commission into a true management organization, in addition to filling a number of gaps and uncertainties. Thus the area covered by the Antigua Convention in the Eastern Pacific is now defined precisely. It is also vast, since it is bounded, on the east, by the coastline from Canada to Chile between the 50 °N and 50 °S parallels and, on the west, by the 150 °W meridian, thus encompassing part of French Polynesia and reaching the waters of Kiribati and Hawaii, United States. The Commission has been institutionally strengthened with the establishment of a Committee for the Review of Implementation of Measures Adopted by the Commission and of a Scientific Advisory Committee. The functions of the Commission have been updated and expanded to enable it to perform its tasks and adopt conservation and management measures, "giving priority to tunas and tuna-like species". These tasks and measures cover a broad range of areas, such as scientific research, data collection, allowable catch, fishing capacity or effort, new entrants, species belonging to the same ecosystem, waste and discards, gear, allocation, application of the precautionary approach, and implementation of the Code of Conduct for Responsible Fisheries and its international plans of action. Its decisions, which must be adopted by consensus, are binding. In its decision-making processes and other activities, the Commission must promote transparency. Provisions have been included on the settlement of disputes. The rights and obligations of the Commission members concerning implementation, compliance and enforcement have been specified, as have the duties of those members in their character as flag states.

In the same spirit of openness that characterized the negotiating process, the condition of "Party" to the Antigua Convention, either through signature followed by ratification or through accession, may be aquired by the Parties to the 1949 Convention, by the coastal states of the region (states with a coastline bordering the Convention area) and by the states and regional economic integration organizations whose vessels fish for fish stocks covered by the Convention. Moreover, and most innovatively, the Antigua Convention makes full use of the concept of fishing entity introduced in the 1995 UN Fish Stocks Agreement to enable Taiwan Province of China to participate fully in the work of the IATTC. To this end, throughout the provisions of the Convention, a distinction is made between two categories: on the one hand, the "members" of the Commission and, on the other, the Parties to the Antigua Convention. The members of the Commission are defined as including the Parties and "any fishing entity" that has expressed its "firm commitment to abide by the terms of the Convention".[5]

This means that states and the regional economic organizations (e.g. the EU), are necessarily both Parties and members while the fishing entity can only be a member. The specific competences of each one of these two categories are also clearly and precisely stipulated (for instance, all members are entitled to take decisions under Article IX, except those decisions related to the adoption of amendments to the Convention, which are the exclusive competence of Parties).

The Antigua Convention was opened for signature in Washington on 14 November 2003. By the end of May 2004, 11 states had signed it and the fishing entity had also signed its respective instrument. The Antigua Convention will enter into force once seven of the Parties to the 1949 Convention have deposited their instrument of ratification, approval, acceptance or accession.

[1] In June 1998 the IATTC adopted a resolution establishing a working group to review the 1949 Convention. The working group met 11 times from October 1998 to June 2003. The full text of the Convention is available at http://www.iattc.org/PDFFiles2/Antigua%20Convention%20Jun%202003.pdf; accessed September 2004.

[2] All parties participated in the negotiating process. Their number grew during the negotiations. They totalled 13 in June 2003: Costa Rica, Ecuador, El Salvador, France, Guatemala, Japan, Mexico, Nicaragua, Panama, Peru, the United States, Vanuatu and Venezuela.

[3] Canada, China, Colombia, the Republic of Korea as well as the fishing entity that will have the possibility of becoming a member of the Commission (but not a Party to the Antigua Covention) under the name "Chinese Taipei".

[4] Op. cit., see footnotes 11, 13 and 14, pp. 27 and 35; for Agenda 21, see http://www.un.org/esa/sustdev/documents/agenda21/index.htm; accessed September 2004.

[5] The Parties are themselves legally "bound" by the Convention; they are not merely committed to abide by its terms.

development plans, conflicts between sustainable aquaculture development and efforts to improve food security and alleviate poverty, and the high cost of compliance for small enterprises number among the possible reasons for slow progress in the development of an enabling environment for responsible aquaculture in many developing countries.

Policy and governance

The aquaculture sector continues to expand, diversify, intensify and advance technologically, and still dominates all other animal-producing sectors in terms of growth. The shift in the perception and objectives of aquaculture development is probably one of the important factors behind this growth. Aquaculture is now perceived not only as an activity for meeting producers' food needs, but also as part of the engine for economic growth and achieving diverse societal and environmental goals. As the thinking shifted from aquaculture development to aquaculture for development, so did the laws and policies governing the sector.

In the past, development policies focused mainly on production; in contrast, recent global aquaculture governance and policies have tended to target both the supply and demand side of the sector, with sustainable development (economic, social, environmental, legal and institutional) as the desired outcome. On the supply side, it is now recognized that sustainable aquaculture development must be adequately regulated and protected by integrated and effective legal and administrative frameworks, and that enabling public policies and legislation granting investors, *inter alia*, legal rights to land supporting the farm and to good-quality water are of the highest priority.

A common feature of emerging aquaculture regulations is the obligation to acquire permits or licences to establish a farm. These give farmers the right to establish and operate aquaculture facilities and at the same time allow governments to monitor the environmental sustainable development of aquaculture and to impose conditions that compel farms to be operated towards this end. Many countries, particularly developed countries, are making efforts to simplify the process of obtaining permits, particularly where several agencies are involved. While permits are often mandatory in developed countries, developing countries have introduced permit requirement policies only recently, probably in response to the emergence of industrial commercial farms.

The FAO Code of Conduct for Responsible Fisheries, although voluntary, is having significant influence on aquaculture governance and policy. Several mandatory international instruments also have an impact on aquaculture at the national level, particularly with regard to traded aquaculture products and the movement of live organisms and germplasm. For example, the international Convention on Biological Diversity (CBD) could restrict the exchange of germplasm and movement of genetically modified organisms.[25] Additionally, part of the CBD Programme of Work assesses the consequences of mariculture for marine and coastal biodiversity and promotes techniques that minimize adverse impacts. The WTO has a number of binding agreements which, *inter alia*, define minimum quality and safety standards for traded aquatic organisms and establish a list of notifiable diseases (the Agreement on Sanitary and Phytosanitary Measures).[26] Matters of concern to aquaculture in the WTO Agreement on Trade-related Implications of Intellectual Property Rights include the extent to which the agreement allows for the transfer of environmentally sound technology and the patenting of living organisms. The Convention on International Trade in Endangered Species of Wild Fauna and Flora (CITES) calls for certificates of

[25] For further information, see http://www.biodiv.org/convention/articles.asp; accessed September 2004.
[26] Summaries and legal texts of the WTO Agreements are available at http://www.wto.org/english/docs_e/legal_e/legal_e.htm#agreements; accessed September 2004.

Box 6

Microfinance in fisheries and aquaculture

Microfinance can be defined as the provision of a broad range of financial services, including loans, savings and insurance, to segments of the population who may lack access to traditional financial services. Most microfinance programmes aim to promote and protect income and empower these population segments. More specifically, the development objectives of microfinance for poor fishing communities are to enable fishing households to increase their income, smooth consumption, develop microenterprises, manage risks better and enhance their earning capacities, thus reducing their economic and social vulnerability. Because women constitute a significant proportion of poor fishing households, microfinance can also serve as an effective tool to assist and empower women in fishing communities.

The demand for financial services in the fisheries sector is diverse and requires differential products and services. Microfinance is just one means in the continuum of financial services provision to cater to that demand. Characterized by small loans, microfinance has inherent limitations in terms of financing the capital investment needs of the fishing industry. It should therefore supplement, not replace, traditional lending products from mainstream financial institutions, as the latter are still required to finance medium- and large-scale investment needs and priorities necessary for the growth and development of fisheries.

Microfinance programmes can be a powerful tool also in poverty alleviation. In the case of fishing and fish-farming communities, the alleviation of poverty is an important precondition for their participation in efforts to rehabilitate and conserve the aquatic environment and fisheries resources.

The mechanics of microfinance operations basically involve three levels:

1. the borrowers who take out loans that they invest in microbusinesses;
2. the loan delivery and recovery system;
3. the institution or organization that manages the delivery system.

The successful operation of these levels is premised on the twin principles of client discipline (where borrowers take responsibility for their decisions and agreements made with the lending institution) and institutional discipline (where the lending institution offers and provides products and services that are characterized by quality, efficiency and commitment).

A core principle that has been proved by successful microfinance programmes is that the poor have the capacity to repay loans, pay the real cost of loans and generate savings.

Source: FAO. 2003. *Microfinance in fisheries and aquaculture: guidelines and case studies*, by U. Tietze and L.V. Villareal. FAO Fisheries Technical Paper No. 440. Rome.

origin for cultured species on the endangered list, issued by the competent national authority, before they can be traded.[27]

At the national level also, aquaculture policies are being established to stimulate development. Many governments have intervened at the macro level by designating aquaculture as a priority area in their economic agendas, defining goals and targets and establishing guiding strategies to achieve them. They have also facilitated reasonable access to credit, provided fiscal incentives and removed institutional constraints (e.g. by establishing effective aquaculture administrative frameworks) (see Box 6). In many instances, however, aquaculture administration still falls under more than one agency, which often hinders progress. At the micro or farm level, governments have intervened with start-up policies such as financing research, providing stocking material and extension and advisory services, and, in some instances, providing loans. The inability of potential entrepreneurs in infant industries to afford the initial investment through their own equity or to obtain private funding, and their lack of absolute and competitive advantage, are often cited as justifications for government intervention at the farm level. Once aquaculture has taken off, farmers have often found it difficult to expand, forcing governments to intervene through expansionary and export promotion policies such as those targeting the lack of availability and/or high costs of essential inputs (feed, seed and capital).

Governments have also encouraged the aquaculture sector through market promotion policies, the development of new value-added products and the regulation of aquatic food safety. In addition to the regulations relating to the drugs and feed used in aquaculture, special regulations have also been issued on the processing and packaging of aquaculture products to prevent health hazards and safeguard consumers.

[27] For further information, see http://www.cites.org; accessed September 2004.